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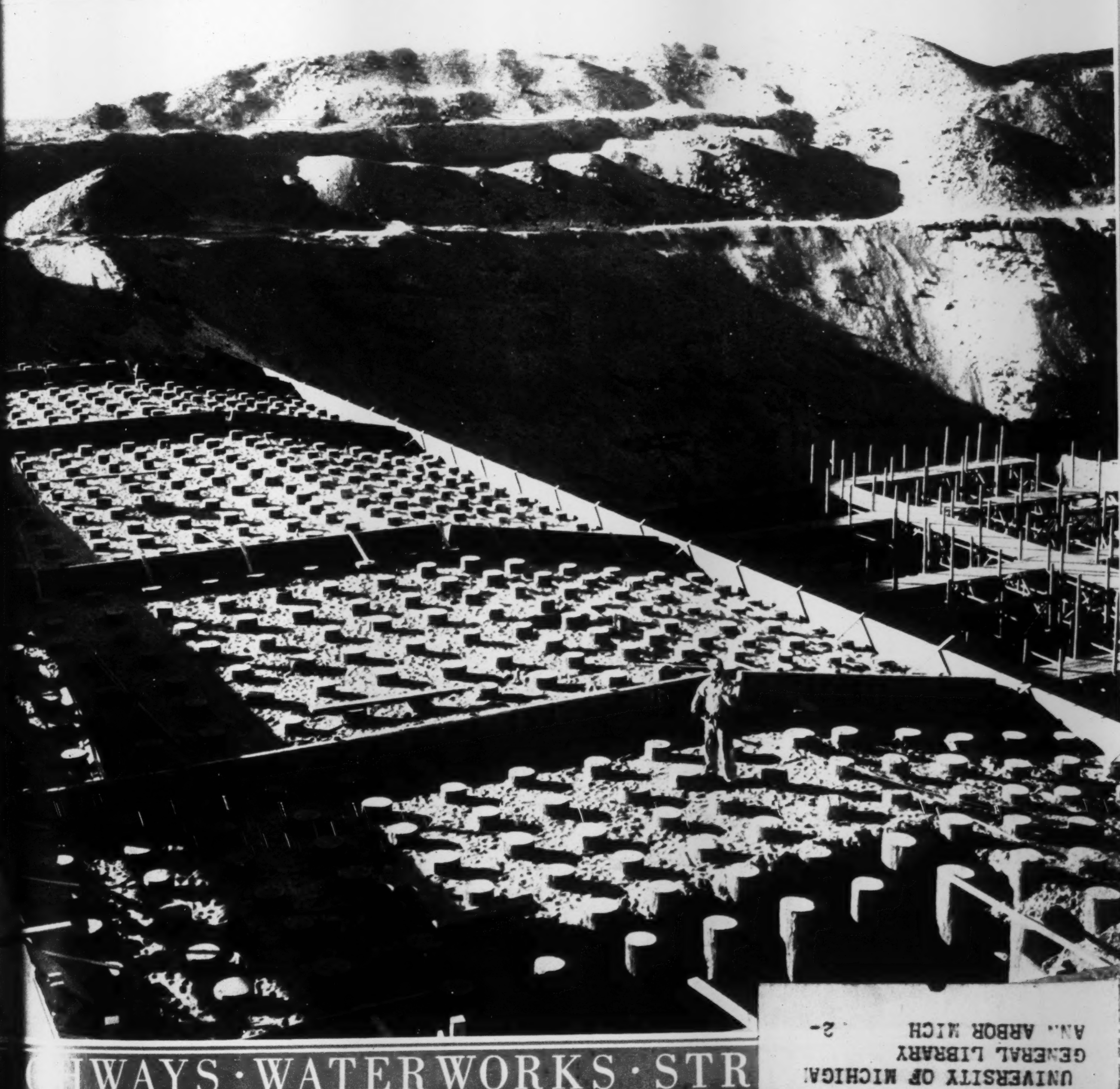
May 12, 1938

Pile foundation for an All-American Canal power drop



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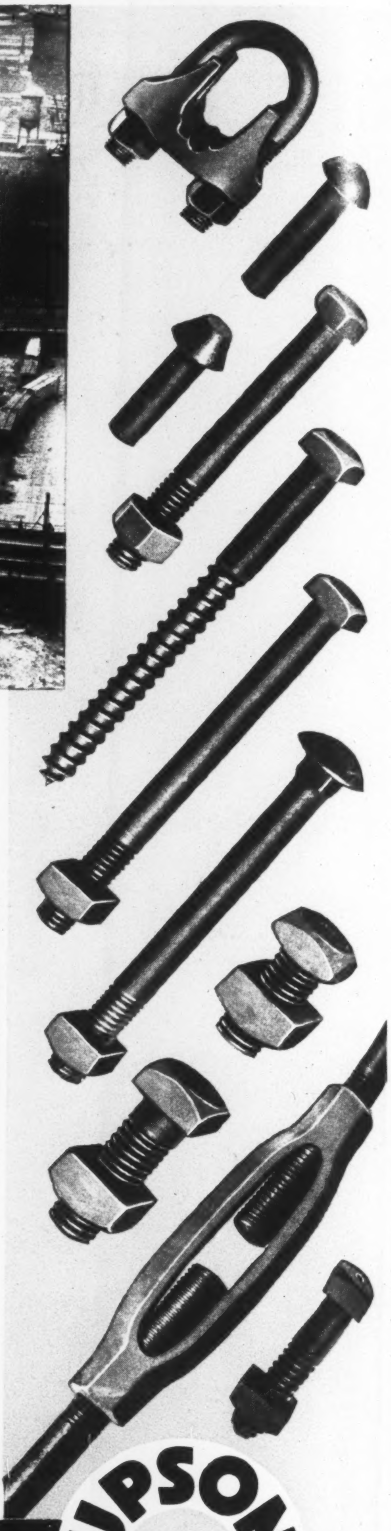

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Vol. 120 *MAY 12, 1938* No. 19

THIS WEEK AND NEXT

GRAND COULEE'S number one tough nut awhile back was the removal of the east cofferdam. The units of the coffer walls were so solidly founded and closely interlocked that they had to be wrenched to pieces. Robert J. Jenks tells how this was done.

Engineers of the M. W. Kellogg Co. last year solved an unusual rigging problem when they lifted a 230-ton still out of Lake Michigan and loaded it onto cars without the aid of large derricks.

With eleven-foot lanes, center parting strips on 4-lane roads, and other progressive road features, California's highways are among the most modern from a design and safety standpoint. An article in this issue on California roads is the third in a series of state highway articles which stress the individual commonwealths' problems.

Henry D. Dewell recounts the satisfactory 5-year operating record of refillable, floating-plate type joints in tanks at a water pretreatment plant.

Touching on water works problems ranging from accounting practice to zeolite softening, the technical sessions at the American Water Works Association convention gave everybody an opportunity to get new information on something. Part I of the report starts on p. 691.

NEXT WEEK—The job of building New York's new North Beach airport on top of a fill of 12 million cu.yd. of Riker's Island refuse will be told.

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THE COVER PICTURE shows the foundation for the intake structure at power drop No. 2 on the All-American Canal in southern California west of Yuma, Ariz. A similar pile foundation at bottom of drop (under the falsework) will support the power house. *U. S. Bureau of Reclamation Photo*

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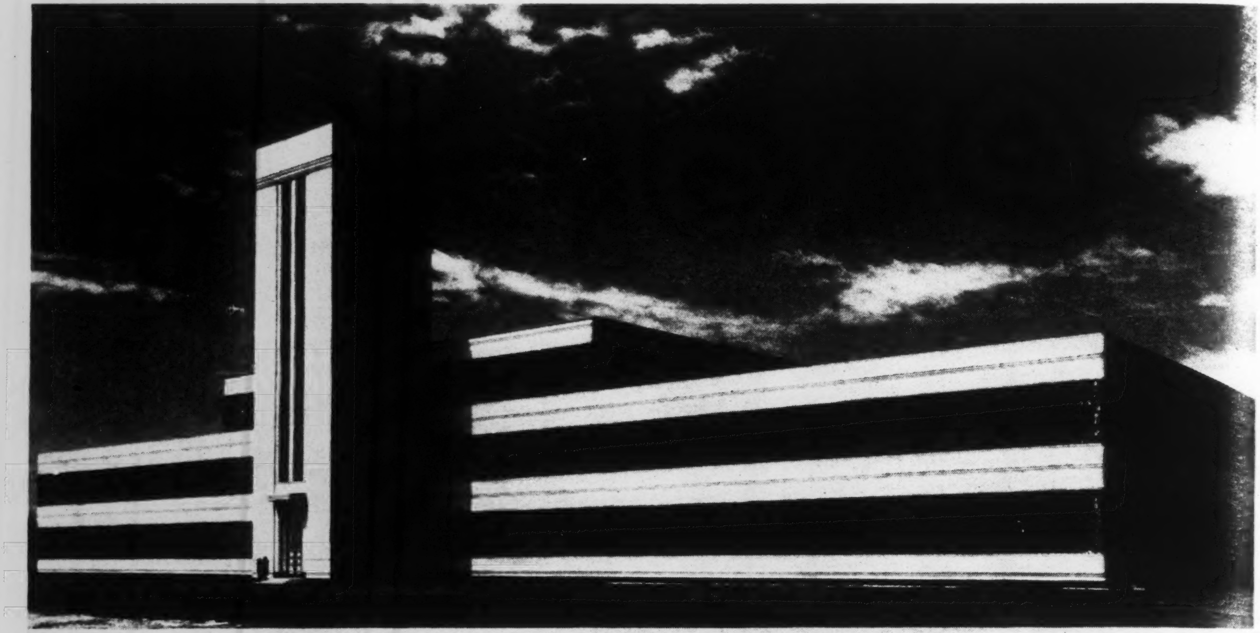
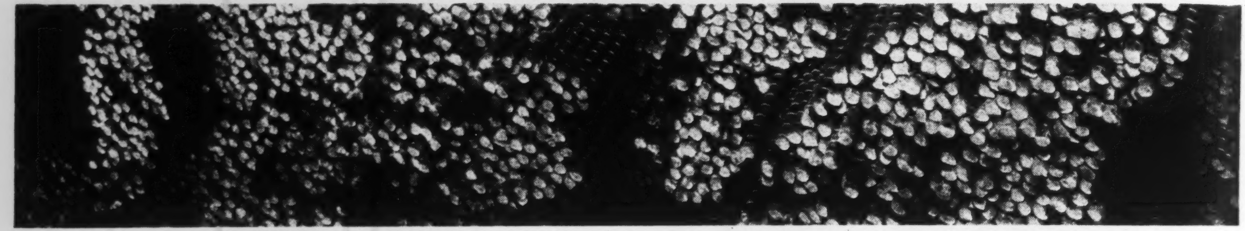


New Home of the Campana Corporation at Batavia, Ill.



Ryerson Reinforcing Used • •

- 152 tons of Ryerson Reinforcing were used by Pere Anderson & Co. Inc., Chicago, in building this imposing new home for the Campana Corporation of Batavia, Ill.

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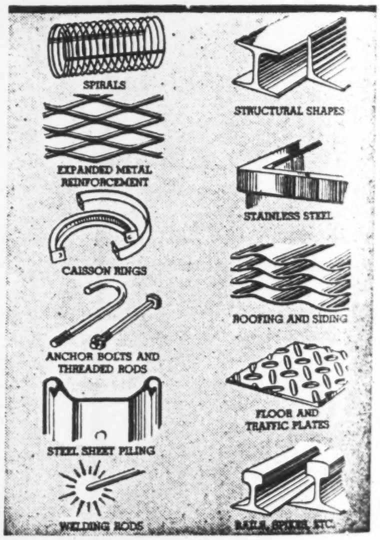
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MAY 12, 1938

THE WEEK'S EVENTS

Pump Priming Bill Is Introduced

Relief funds are earmarked to specific agencies and types of project—$2,519,425,000 appropriation

President Roosevelt's request for the resumption of "pump-priming" expenditures by the federal government led this week to the introduction by Rep. Taylor of Colorado, chairman of the House Appropriations Committee, of a joint resolution appropriating a total of $2,519,425,000 for the use of various relief and construction agencies of the federal government in providing employment and relief.

Public works

Of this sum $965,000,000 is allocated to the Public Works Administration, the life of which is extended until June 30, 1940, for allotment to federal (not over $100,000,000) and non-federal projects, the latter either on the old 45 per cent grant and 55 per cent loan basis or, in special cases where constitutional limitations prevent participation in this manner, as advances to public agencies on an agreement that at least 55 per cent of the cost (with interest) will be paid back in the form of rental over a period of not more than 25 years.

Eligible projects are limited to those on which construction can be started before January 1, 1939, and substantially completed by June 30, 1940, and no applications will be received by PWA after Aug. 31, 1939. Within a few hours of the bill's introduction, Sec. Ickes instructed all PWA regional offices to call this time limit to the attention of possible applicants for funds and to use every legitimate means of expediting the preparation of new applications for submission as soon as the bill passes.

Total grants may not exceed $750,000,000 and PWA is empowered to use proceeds from the sale of bonds to make additional loans up to a limit of $500,000,000. The $965,000,000 of direct appropriation, with the $500,000,000 revolving fund from municipal securities turned over to PWA, makes a possible total of $1,465,000,000 for the new program, of which not more than $750,000,000 can be used for grants.

Testimony before the House subcommittee that prepared the bill brought out the fact that PWA has 2,714 approved non-federal applications on hand involving grants totalling $438,390,218 and loans of $132,167,500. These would have a total estimated cost of $1,007,440,512.

Federal building program

As an additional stimulus to employment the bill, in a separate section, increases the authorization for federal building construction outside of the District of Columbia from $70,000,000 to $130,000,000 and actually appropriates $25,000,000. This program is administered by the Procurement

Continued on page 671

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More Regional Bids Asked on Cement

The Procurement Division of the federal Treasury on May 5 asked for bids to furnish cement for the use of the federal government in five widely separated regions. The division thus continues the policy of asking for bids on a regional basis which was indicated in last week's request for bids in the California area (*ENR*, May 5, 1938, p. 633).

Although adhering in principle to the new method of accepting bids f.o.b. mill only, the government has made the concession of permitting producers to set prices at either a point of production or a point of storage. It is explained that several manufacturers who maintain storage silos have requested permission to supply government requirements from these points.

Bids in the five regions are to be opened on May 17 and 18. In New Jersey, 5,500 barrels of portland cement is wanted. In Ohio and West Virginia, bids are requested on two lots of portland cement totaling 17,500 barrels, and on 12,000 barrels of moderate heat cement; 2,500 barrels of sulphate-resisting cement are wanted in Oregon and 2,418 barrels of portland cement in Utah. In Colorado and Texas bids are asked on 2,160 barrels of portland and 15,440 barrels of high-early strength cement.

Delaware Aqueduct Contracts Let

Taxpayer's injunction against wage rates established as prevailing dismissed by court

The New York City Board of Water Supply awarded six contracts May 9 for sections of the Delaware water supply aqueduct. The action was taken as the Appellate Division vacated a temporary injunction against award of the contracts and dismissed a taxpayer's suit in which the claimant asserted that the rate schedule established for the contractors was too high (*ENR*, April 28, 1938, p. 607).

Three of the contracts now awarded, contracts 322, 323 and 324, were bid on last fall and contracts were approved. At that time, however, criticism of the wage rates established as prevailing led the board to throw out the bids. Last February new and lower wage rates were certified as prevailing and bids were re-advertised (*ENR*, Feb. 17, 1938, p. 250).

Successful bidders

The contract awards were as follows:

Contract No.	Contractor	Bids
307	S. A. Healy Company...	$10,097,000
308	J. F. Shea Co. and Henry J. Kaiser Co..........	11,972,000
322	Utah Construction Co....	10,830,000
323	Seaboard Construction Co.	10,810,000
324	S. A. Healy Co..........	10,985,000
339	B. Perini & Sons, Inc....	2,869,000
	TOTAL	$57,563,000

Contract No. 339 is for stream diversion dam and tunnel at Lackawack Dam, and all the others are for sections of the West Branch-Kensico tunnel and the Kensico-Hillview tunnel.

Not all low bids

All of the contracts except No. 324 were awarded to the low bidders. On this contract, the Healy company bid $114,962 more than the lowest bid. Contract 324 also was the only one which was awarded to the same contractor who would have received the award at the time of the first letting last fall. At that time the low bidder on contract 322 was George H. Flinn and on 323 was Johnson, Drake, and Piper, Leo Butler, and Seims Helmers.

(Continued on page 670)

Road Fund Level Held By House

Increased penalty for road tax diversion by states is voted down through approved committee

Complete approval of the continuation of federal highway expenditures at the present rate during the fiscal years 1940 and 1941 was voted May 6 by the House of Representatives which, with one major exception, passed the federal-aid authorization bill substantially as reported by its committee on roads.

The committee was overruled on its proposal that the penalty for diversion of motor vehicle revenues by a state be increased from one-third of its federal-aid allocation to two-thirds. This provision was deleted from the bill after considerable debate indicating that the majority of the members oppose "telling the states what they can do with their tax money."

The bill, as passed by the House, authorizes federal highway expenditures totalling $238.000.000 for each of the two years, divided as follows:

Regular federal aid	$125,000,000
Secondary or feeder roads	25,000,000
Grade crossing eliminations	50,000,000
Forest roads and trails	14,000,000
Public-lands highways	2,500,000
National park roads and trails	7,500,000
National parkways	10,000,000
Indian reservation roads	4,000,000

In presenting the bill to the House, Chairman Cartwright stated that the committee had been unable to agree with the President's recommendation for a reduced level of highway expenditures, and that the bill as written has the unanimous approval of the committee.

Testimony brought out the fact that highway improvements totalling $3.664.296.000 are now needed on the various state highway systems.

• • •

Senate Accepts Increase In 1939 Road Funds

The Senate on May 9 passed the Department of Agriculture appropriation bill for the fiscal year 1938-1939 without changing the $201.500.000 approved by the House for highway construction (*ENR*, April 21, 1938, p. 556).

The bill carries $125.000.000 for federal aid allotments as compared to $63.000.000 provided in the budget. Changes made by the Senate in provisions of the bill not relating to highways make it necessary for the House to reconsider the measure before it can be sent to President Roosevelt for approval.

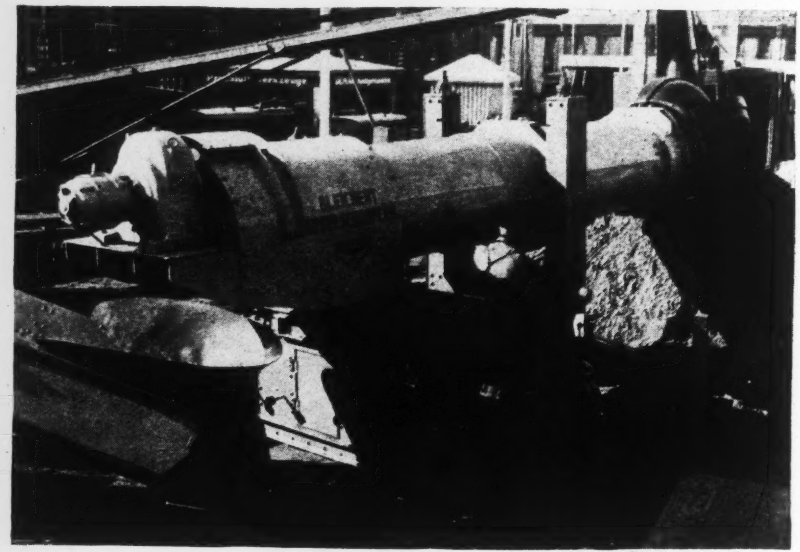


Photo from European

GERMAN MATERIALS HANDLER

AN UNUSUAL PRINCIPLE is employed for handling gravel in this German device. The electrically driven blades in the front rotate, picking up the material, and a belt in the large tube carries it to the rear where it is discharged into a hopper and then delivered by a moving belt to a truck.

New Truck Law Signed In South Carolina

Governor Johnston of South Carolina on April 30 signed a new truck law limiting vehicle weight to 40.000 lb. and width to 96 in. (*ENR* Apr. 21, 1938, p. 556). The law replaces the drastic provision limiting total weight to 20,000 lb. and width to 90 in. which was upheld last February by the U. S. Supreme Court.

In signing the new law, Johnston pointed out that the existing law had never been enforced and that therefore there are no real restrictions at present on the use of South Carolina highways.

• • •

Labor and Material Bonds On New York Highway Job

New York State will require labor and material bonds from all contractors awarded state contracts after July 1, according to a ruling by Comptroller Tremaine. A bill passed by the last session of the legislature gives the comptroller authority to require such bonds.

It had been expected in some quarters that highway contractors would not be required to furnish such bonds, since for many years performance bonds which are required on all other state contracts have been optional on highway contracts.

It is understood that a bond covering both performance and labor and materials will be supplied at the same 1 per cent premium rate now charged for performance bonds only. It is expected that a new rate for labor and material bonds alone will be set for those contractors who wish to continue to dispense with performance bonds on highway work.

• • •

Contestants Get Cash In Design Competition

Before a hundred guests at a dinner in New York on the evening of May 5, the American Institute of Steel Construction distributed $9,000 in prizes to the successful contestants in its competition for the design of an elevated highway. Of the 273 designs submitted, about 100 were exhibited in the dining room as evidence of the great interest shown.

The first prize of $5,000 went to Hazelet & Erdal, consulting engineers of Chicago. Second prize of $2.000 went to E. H. Praeger, chief engineer, and C. F. Lloyd, architectural designer, Madigan-Hyland, consulting engineers, New York. The third prize of $1.000 went to Walter W. W. Jones, in the office of the Borough President of Manhattan, New York. Ten other contestants received checks for $100. Prizes were awarded by Clyde G. Conley, president of the A.I.S.C., and the decisions of the jury of award were announced by C. M. Pinckney, consulting engineer, New York.

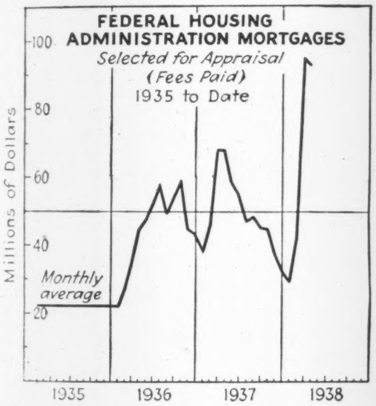
THE CURRENT TREND

This week's news of contract volume and construction cost factors

FHA Mortgage Appraisals Climb

Mortgages selected for appraisal total $1,659,000,000 since 1935, current monthly rate averages $65,000,000

Federal Housing Administration mortgages *selected for appraisal,* (applications for mortgage insurance, with fees paid) total $93,000,000 for April, 37 per cent above the $67,886,000 volume of April, 1937, but a decline of 2 per cent from the high volume of March, 1938 when $95,161,000 was reported. The March, 1938 record volume is 40 per cent above the previous high of $68,045,000 in March, 1937. The April and March, 1938 totals reflect the effect of revision of the National Housing Act passed on February 3, which increased insurance on mortgages to 90 per cent of the appraised value up to $6,000, and to 80 per cent for valuations from $10,000 to $20,000.



Mortgages *selected for appraisal* total $260,677,000 for the first four months of 1938, an average of $65,169,000 per month. This compares with a $49,122,000 average per month for the year 1937; $44,907,000 per month for 1936; and $22,500,000 for 1935. The total amount of mortgages *selected for appraisal* since the FHA began operations is $1,659,000,000.

Mortgages *accepted for insurance* for April, $63,000,000, record the highest volume for any month since the beginning of FHA operations. They exceed March, 1938 by 58 per cent, April, 1937 by 26 per cent, and bring the grand total of mortgages *accepted for insurance* to $1,198,000,000.

It is estimated by the FHA that 65 per cent of mortgages *accepted for insurance* in March and April, 1938, represent new home construction, and 40 per cent are eligible for 90 per cent mortgage financing under the terms of the amended National Housing Act. For 1937, FHA estimated that 56 per cent of the $447,520,000 in mortgages *accepted for insurance* was for new home construction. These percentages do not include operative builders, since builders do not get the names of individual borrowers on paper for several months.

For this and other reasons mortgages *selected for appraisal* will be used in future reports as the best index of current housing financing trends.

Building Permits

March permit valuation of building construction in 2032 U. S. cities totals $121,011,809, an increase of 19.1 per cent over February, but a decrease of 31.3 per cent from March, 1937 according to the Bureau of Labor Statistics. Of the March, 1938 total, $55,761,221 is for new residential buildings, an increase of 71.8 per cent over February; $38,238,097 is for non-residential construction, a drop of 15 per cent from the preceding month; and $27,012,491 is for alterations and repairs, 11.6 per cent higher than a month ago.

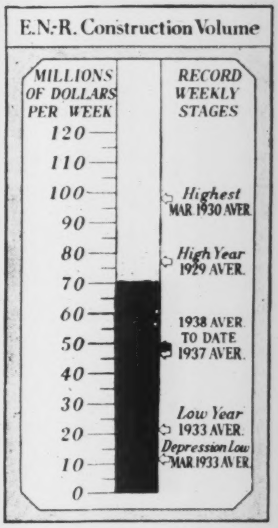
During March 14,850 new family dwelling units were provided, 57.6 per cent more than in February, with every section of the nation participating.

Total permit values for the first quarter of 1938, $392,852,000, are 2 per cent below the corresponding 1937 quarter. New residential construction is 4.1 per cent lower than a year ago; alterations and repairs are 11 per cent lower; while non-residential construction is 7.3 per cent above the 1937 quarter.

Business Briefs

INDEX OF SHIPMENTS of construction materials stands at 66 for March, 1938, an increase of 53 per cent over the February index as reported by the PWA National Resources Committee. The March index, however, is 9.5 per cent below March, 1937. Base, 1929=100.

FABRICATED STEEL PLATE orders for March, 1938, total 38,052 short tons, 114 per cent higher than orders in February, but 47 per cent below March 1937 volume. New orders for the first quarter of 1938, 79,301 tons, are 45 per cent under the 1937 quarter.



THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending MAY 13 1937	May 5 1938	May 12 1938
Federal	$4,492	$2,625	$3,700
State & Municipal	27,745	18,128	49,800
Total public	$32,237	$20,753	$53,500
Total private ...	30,464	15,569	17,020
TOTALS	$62,701	$36,322	$70,520

Cumulative
1938 (19 weeks)..........$954,901
1937 (19 weeks)..........$858,169

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

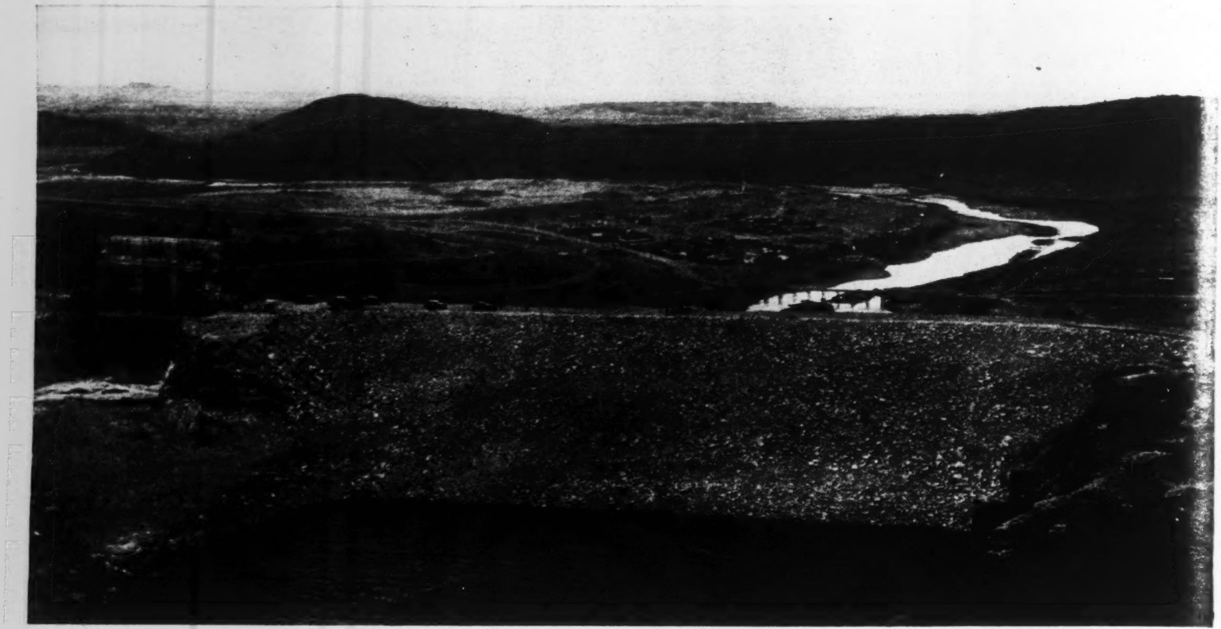
	Cumulative 1937 19 Wk.	1938 19 Wk.
NON-FEDERAL	$520,426	$453,324
State & Mun. bonds.	212,243	225,132
Corporate securities...	229,666	109,250
PWA loans, grants....	48,578	2,029
RFC loans	29,939	63,420
U.S.H.A. loans	......	53,493
FEDERAL	......	86,532
TOTAL CAPITAL ...	$520,426	$539,856

F H A MORTGAGES

	Cumulative 1937 18 Wk.	1938 18 Wk.
Mortg. selected for appraisal	$235,318	$283,027

ENR INDEX NUMBERS

Index Base	1913	1926
Construction Cost (May)....	236.80	113.83
Building Cost (May)........	197.86	106.95
Construction Volume (Apr.).	176.00	77.00



Bureau of Reclamation photo

RECLAMATION DAM COMPLETED

ALCOVA DAM, recently completed diversion structure of the Kendrick project, was built by the U. S. Bureau of Reclamation on the North Platte River 30 miles southwest of Casper, Wyo. The rock and earth dam is 180 ft. high, has a 900 ft. crest length, and will store 160,000 acre-ft. of water to irrigate desert land west of Casper. The Casper canal will carry water from the reservoir above Alcova Dam to irrigate 35,000 acres of desert land.

Parker and Bock Promoted To New TVA Posts

Theodore B. Parker, chief construction engineer for the TVA since 1935 has been appointed chief engineer of that agency, and Carl A. Bock, assistant chief engineer, has been made chief consulting engineer. Both positions carry the maximum TVA staff salary of $9,500 per year.

The position of chief engineer has been vacant since July, 1937, when Arthur E. Morgan relinquished the title in a reorganization by which the three directors concentrated their activities on policy determination. The position of chief consulting engineer is a new one.

Parker joined the TVA staff in 1935 as supervising construction engineer. Prior to his appointment he was for a year PWA director in Massachusetts and had been connected with Stone & Webster for eleven years. He served with the 26th Engineers during the war. Parker is a graduate of Massachusetts Institute. He is 48.

With the TVA since its inception, Bock was the first member of the staff appointed by the board after its creation. He served first as coordinator, then secretary and later as director of engineering and geology. Now 55 years old, Bock has been engaged on water control engineering continuously since 1912, when he joined the Morgan Engineering Co. of Memphis. He held responsible positions on the Miami flood control project in Ohio and the Pueblo Conservancy Project in Colorado. He is a graduate of Cornell College, Iowa.

• • •

TVA Makes Contracts For Power Sale

Wholesale power contracts under which the Tennessee Valley Authority will serve the cities of Columbia, Tenn., and Aberdeen, Miss., have been approved by the directors of the TVA.

Columbia, which is now served by Tennessee Electric Power, has a population of about 8,000. Its citizens recently approved a municipal bond issue for a distribution system by a vote of 911 to 440. It will be served by means of a high-tension line already constructed to the city by TVA to serve Montsanto Chemical.

Aberdeen, a city of about 4,000 population, approved its bond issue by a vote of 610 to 42. Located near Columbus and Starkville, both of which recently negotiated TVA power contracts, it will be tied in with Oklona, which has been using TVA power since 1935. The city is now served by Mississippi Power Co.

Negotiations are now in progress for the purchase of the existing distribution systems by the two cities.

Western Bridge Engineers Discuss Specifications

An informal technical session of the Western Association of Bridge Engineers meeting as the bridge committee of the Western Association of State Highway Officials in Salt Lake City, May 2-4, was devoted to preparing recommendations to the bridge committee of the American Association of State Highway Officials for revision of specifications for highway bridges.

The meeting is one of a number being held by Albin L. Gemeny, chairman of the bridge committee of the American Association of State Highway Officials.

Subjects discussed by the western group included revision of loading specifications for highway bridges, particular attention being paid to the new S and T loadings. Maintenance and inspection of bridge and methods of collecting, tabulating and using data were discussed as were unit stresses in highway bridges, flange compression in bending, reinforcing steel, cutoff of timber piling, steel bearing piles, and revision of the handrail specifications.

In addition to developing recommendations for revision of standard specifications, the present meetings are intended, Gemeny said, to evolve a workable rating system to give load ratings for old highway bridges for which no design data are available.

Tri-County Project Is Attacked

PWA defends its handling of Nebraska hydro-electric project at House hearing

Protests against the construction of the Tri-County power and irrigation project in Nebraska by members of the Platte River Water Protective Association, and an answer by the Public Works Administration to charges made against the plan, have been made public by the publication of hearings on the pump-priming bill before a House appropriations sub-committee.

The principal charges made, and the answers of PWA, are as follows:

1. The waters of the Platte River are already over-appropriated, the association asserts, and irrigation development in Wyoming and western Nebraska have already decreased river flow to such an extent as to damage existing water rights on the lower river. This decrease in the flow has adversely affected the underground water level depended upon for subirrigation to some 5,000,000 acres of land, and construction of the Keystone Dam will aggravate these effects.

To these allegations PWA replies that its own studies and an extensive inquiry by the Nebraska Department of Roads and Irrigation indicate that there is unappropriated water in the Platte, and this has since been assigned to Tri-County—a grant which has since been upheld by the Nebraska Supreme Court.

2. The association says that there is no adequate market for the power to be produced by the three major Nebraska districts and that, to secure a market, it is proposed that the districts buy out existing private utilities against their will.

PWA rejoins that "We have always recognized that some period must elapse after completion of the projects before they will be able to market all of their power. Our determination as to the security of the loans gave full consideration to this factor. . ." As to the negotiations with the utilities, these are entirely in the hands of the districts. PWA is informed that such negotiations are progressing favorably.

3. That soil conditions in Nebraska caused the collapse of the Sutherland siphon and are unfavorable for the foundation of the Keystone Dam.

PWA replies that painstaking investigations show soil conditions in and about the Keystone site to be suitable. As for the siphon breaks, the first was the result of faulty operation, in that a great volume of water was run through the unseasoned siphon after an ice dam had formed at the outlet; the cause of the second failure has never been definitely determined.

4. Seepage from the Columbus and Sutherland reservoirs has adversely affected considerable areas, and many damage claims threaten the financial stability of these projects, according to the association. The same condition, but to a greater extent can be expected for the larger Keystone Reservoir.

The validity of the claims, answers PWA, against the first two districts has not yet been passed upon by any court. "We can see no reason for delaying the Tri-County project because of the possibility of a few such claims being upheld."

5. The cities of Ord and Burwell are asserted to have been forced to purchase power from the Columbus district at a higher cost than incurred by their existing municipal plants on the threat that otherwise there would be no PWA financing of a nearby irrigation project.

PWA states that it merely insisted upon compliance with its contract that required advance contracts for the sale of water and power by the irrigation district in sufficient volume to secure the loan. If the cities lose money on the power contracts (and this is not admitted by PWA) it is evidently because they feel that they will be more than compensated by the construction of the irrigation project.

• • •

Cleveland Retains Engineer On River Straightening

Cleveland's project to straighten the 5-mile winding navigation channel of the Cuyahoga River has moved toward actual construction with the retaining of George B. Sowers as special consulting engineer on the project.

The plan adopted by the city and approved by the War Department provides for widening the navigation channel at critical spots, cutting back the points and easing the principal bends, and reconstructing ten narrow highway and railroad bridges so that boats 635 ft. long can navigate the river safely.

The U. S. Engineers have recommended that the federal government do the necessary dredging at an estimated cost of $567,000. The entire improvement plan is estimated to cost about $13,781,000. The city has issued $3,000,000 in bonds for the project.

Sowers was formerly city engineer of Cleveland. He left the city engineering department in 1932, after nineteen years there, to enter private practice. For the past 2½ years he has been chairman of the port and harbor committee at Cleveland.

Power Rate Set At Seminoe

Firm energy will be sold at 6.3 to 7.4 mills per kw.-hr. when dam is completed

Tentative rates for the sale of power generated at Seminoe Dam have been set by Secretary Ickes. The dam, major structure of the Kendrick federal reclamation project in Wyoming, will be completed in 1939.

The power installation at Seminoe will have a capacity of 45,000 hp. Firm energy will be sold at 6.3 to 7.4 mills per kw.-hr., depending upon the volume and conditions under which the energy is accepted. A demand charge of $1.25 per kw. of 30-min. maximum demand per month will also be made. Firm energy, with the demand charge waived, will be sold at 4 to 4.5 mills per kw.-hr., and secondary energy will be sold at 1.82 mills.

Power revenue

The cost of the entire Kendrick project when completed will be about $20,000,000, of which $17,200,000 is to be repaid with interest by the sale of power. Revenues from the power plant are expected to range from an initial $400,000 per year to a maximum of $800,000 annually. Power will be disposed of at wholesale in so far as possible and preference will be given to municipalities and other public agencies.

Seminoe Dam will store more than 1,000,000 acre-feet of water which will be used, in addition to power generation, for irrigation and for regulation of the North Platte River to make possible the diversion at Alcova Dam, downstream, of water for irrigation.

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Pensacola Dam Bids Are Advertised

Bids for construction of the Pensacola Dam of the Grand River project will be opened by the Grand River Dam Authority on June 3. The contract covers construction of the dam and power house and the installation of turbines. At the same time bids will be asked on furnishing four 20,000-hp. turbines and four 16,000-kw. generators, and one 625-kw. generator.

Construction of the dam, which will be a multiple-arch structure with a maximum height of 150 ft., will involve 1,250,000 cu.yd. of earth work, 165,000 yd. of rock excavation, 480,000 cu.yd. of concrete, 9,000 tons of reinforcing steel and 3,000 tons of structural steel.

WASHINGTON HIGHLIGHTS

Special reports by Paul Wooton

In its attempt at centralizing purchasing of cement, the Federal Procurement Division is not following a predetermined mapped path but is feeling its way. The zone-price idea, used in the first bid call on which all bids were cancelled, looked good at first but did not work when tried. It did, however, develop indications that some of the industry at least will cooperate in the mill price system. It also brought letters of protest from the industry. That Secretary Morganthau supported the producers' complaint that manufacturers had no guarantee of receiving an order (*ENR*, May 5, 1938, p. 63) does not necessarily indicate acceptance of all their protests.

The call for bids in California appears to be the first step in asking for bids on a regional basis. The present plan to ask bids on definite quantities makes it necessary to estimate total cement requirements for all federal agencies in each region, and this takes different amounts of time in different localities.

The Senate on May 5 passed and sent to the House Senator Bailey's bill amending the Federal Power Act to permit court review of F.P.C. orders or findings by any aggrieved person, state or municipality. As now worded, the act limits the power of appeal to persons, states or municipalities that have been parties to the proceedings, and to F.P.C. orders only.

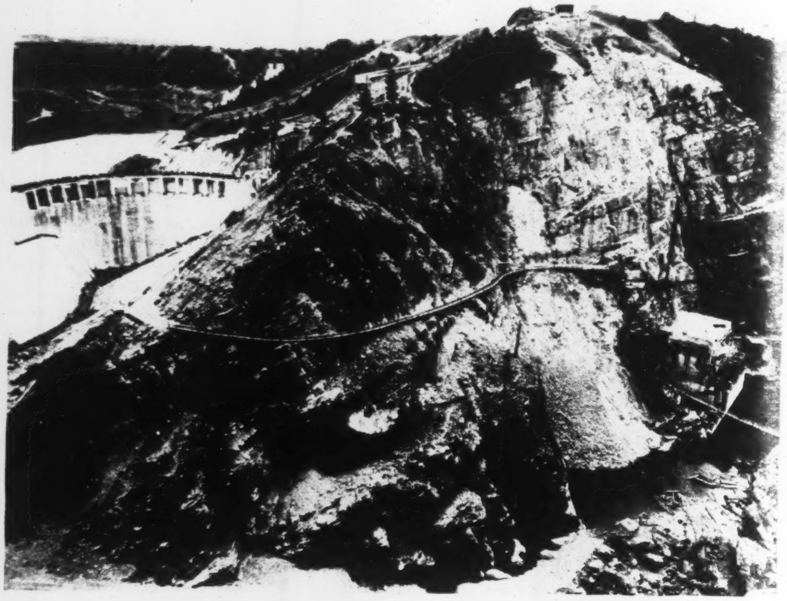
On May 9, however, Sen. Minton of Indiana filed a motion to reconsider the vote by which the bill had passed.

The amendment reflects the dissatisfaction of the state of North Carolina with a ruling of the F.P.C. that the proposed Tuckertown hydro-electric development of the Carolina Aluminum Co. would affect navigability on the lower section of the Yadkin-Pee Dee River and must therefore be licensed by the commission. This ruling is now being contested by the company.

The Pacific Gas and Electric Co. will have until August 1, 1938, to file briefs with the Federal Power Commission supporting its application to build six hydro-electric power plants on the North Fork of the Feather River in California, an extention to that date having been granted May 5 to permit the company ot gather further information in support of its application.

The application is opposed by the Central Valley Authority, which contends that development of the new plants will create an over-capacity in the region and thus adversely affect the marketing of power from the Central Valley development.

Negotiation of an interstate compact between Idaho and Wyoming to apportion the waters of the Snake River was authorized by action of the House of Representatives on May 5 when it accepted a Senate amendment extending the time limit for negotiations to 1940. The bill now goes to the President for approval.



MONTANA HYDRO-ELECTRIC DAM COMPLETED

Polson dam, 200 ft. high, recently completed on Flathead River, Montana, by the Montana Power Co., shown here in its final stage of construction, will form a lake of 1,100,000 acre-ft. to supply the 56,000-kw. hydro-electric power plant in the lower right corner. The trestle along the steep bluff was built to carry the construction railroad. Concrete for the power house came over this railroad after having been chuted down an incline from the mixing plant seen in upper center.

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Long New Jersey Road To Be Lighted

A project for lighting the 56-mile White Horse Pike in New Jersey is now under way and will be completed in June. The Atlantic City to Camden highway, it is believed, will be the longest continuous stretch of lighted highway in the world.

The state highway department is installing incandescent luminaires over the major portion of the highway, and a few sodium units will be installed for experimental purposes.

Delaware Aqueduct Contract Let

(*Continued from page 665*)

In explaining the award of contract 324 to the second bidder, the board of water supply said that the original low bidders had submitted claims against the city for damages amounting to $4,471,000. These three bidders, the board said, agreed to release their claims if contract 324 was awarded to the Healy company. In addition, the board pointed out that the difference between the low bid and the Healy bid is "relatively unimportant in view of the nature of the work" and that the Healy company has had more extensive experience in tunnel construction work similar to that covered by the contract.

The Delaware aqueduct

The present tunnel contracts are for links in the $275,000,000 Delaware-Rondout water supply aqueduct, which is being built by the city of New York to increase its present water supply of 1,039 m.g.d. by 540 m.g.d. It will be completed in about six years.

Contracts amounting to $10,805,000 for construction shafts along the line of the aqueduct were awarded some time ago and are nearing completion.

BRIEF NEWS

In the absence of storms, the Washington state highway department has observed the reactions of its experimental concrete barge on Lake Washington at Seattle by throwing up 4-ft. waves with a powerful tug. The tug, traveling at 12½ knots, circled the barge and is stated to have an effect equivalent to an 85-mile gale. The barge is being used to test the design of the proposed pontoon bridge to Mercer Island. The wash of the tug created a maximum sidesway of 15 in. and a maximum pull on the anchorage somewhat over 30,000 lb. During a 45-mile gale last winter, a maximum pull of 18,000 lb. was recorded.

Fleisher Engineering & Construction Co., general contractors, has moved its main offices from St. Paul to Buffalo. During the past three years the company has completed more than $6,000,000 worth of federal building work in and around Buffalo, and has therefore decided to move.

A committee in London of former students and associates of the late William C. Unwin is raising a fund to increase the endowment for the Unwin scholarship awarded annually at the Central Technical College and to provide finances for a memoir of Dr. Unwin's life. Representatives of the American Society of Civil Engineers and the American Society of Mechanical Engineers are cooperating in these endeavors.

The shortest tunnel of the Colorado River Aqueduct was put under construction during the week of April 26, when work started on the Rockdale Tunnel within the city of Los Angeles. The tunnel, 262 ft. long and 6 ft. in diameter, is being driven by the J. F. Shea Co., which holds the contract for the Palos Verdes cross feeder, of which the Rockdale tunnel is a part.

The abandoned right-of-way of a Canadian National Ry. branch line between Farnham and Iberville, Que., will be converted into a highway if the provincial roads department obtains its request from the Board of Railway Commissioners for permission to buy the right-of-way. The department is planning a similar project in the event that the C.N.R. obtains permission to abandon its line from St. Isidore to the American border.

Road taxes in the province of New Brunswick are collected by the district highway engineers, under a recently instituted plan. These have been made by specially appointed collectors.

Pump Priming Bill Is Introduced

Continued from page 665

Division of the Treasury. The remaining $35,000,000 must be appropriated later by Congress.

Other provisions

Other appropriations carried in the bill include the following items:

Works Progress Administration	$1,250,000,000
National Youth Administration	75,000,000
Farm Security Administration	175,000,000
Puerto Rico Reconstruction Administration	6,000,000
To regular federal agencies for administration, compensation, employment agencies, etc.	18,625,000
National Emergency Council	250,000
National Resources Committee	250,000
Prison Industries Reorganization Administration	120,000

The outstanding change in the bill, as compared with previous relief appropriations, is that the old practice of voting a lump sum to be allocated to the various relief and regular agencies at the discretion of the President has been modified, and specific sums are now earmarked for the use of each of these. However, Presidential approval is still required for specific allocations under PWA, WPA and NYA, and flexibility is provided by a provision that PWA may transfer not more than $50,000,000 of its money to any other federal agency.

There is also a provision that classifications of projects under WPA may not be increased in total by more than 15 per cent above the following maximums specified in the bill: $425,000,000 for roads, streets and highways; $250,000,000 for so-called "white-collar" projects; and $575,000,000 for general construction work.

All funds are intended to last for the entire fiscal year ending June 30, 1939, except the appropriation to WPA, which is on a seven-months basis ending Feb. 1, 1939. Congress will consider an additional appropriation at that time in the light of existing conditions of employment.

The bill takes care of all recommendations for a spending program made by President Roosevelt in his message of April 14 except the following: 1. $300,000,000 additional authorization for the U. S. Housing Authority, now under consideration in separate legislation; 2. $50,000,000 additional for the CCC, already approved by Congress; 3. $100,000,000 additional for highways, included in the pending Agriculture Department appropriation bill; 4. $37,000,000 additional for flood control, included in the War Department non-military appropriation bill, which has passed both Houses and is in conference.

LABOR NOTES

Protest by the Seattle Building Trades Council forced King County to return to PWA financing for a new hangar at Boeing Field after an attempt to use WPA workers on the project. After initial attempts to obtain PWA funds were unsuccessful because PWA allotments were not being made, the county attempted to have the hangar built as a WPA project. Secretary Monrean of the Seattle Building Trades Council wrote the county commissioner that his organization opposed the WPA plan. He enclosed copy of a letter he had sent to Senator Bone pointing out that although the WPA constructed buildings at the Naval air base, the unions were unable to do anything in that case "because United States Marines are guarding the place. . . . But that condition will not exist at the Boeing Field. . . ."

A considerable portion of residential building work in the Detroit area was tied up May 2 by a dispute between the master plasterers' and Contractors' Association and AFL unions of plasterers, lathers, and plasterers' laborers. After the unions called their members off jobs, the contractors association stopped all their work.

A system-wide election among employees of the Tennessee Electric Power Co. of Chattanooga has been ordered by the National Labor Relations Board. Employees will determine whether they wish to be represented in collective bargaining by the International Brotherhood of Electrical Workers, A.F.L. The system-wide election was ordered in spite of protests by the United Electrical, Radio and Machine Workers of America, C.I.O., who wished to have employees at the Hales Bar and South Pittsburgh, Tenn. plants excluded from the collective bargaining unit. The C.I.O. group holds a contract with the company at these plants, but the N.L.R.B. pointed out that the contract was executed subsequent to filing of the request for an election by the I.B.E.W. The board also noted that the Hales Bar and South Pittsburgh employees performed work closely related to operations at other plants, and that the I.B.E.W. claims to have organized the majority of employees in the system-wide unit.

Civil engineers, draftsmen and surveyors are excluded from the election unless they devote a substantial amount of their time to "the production, transmission or distribution of electricity or operations . . . incident thereto."

News continued on page 695

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Elevated Highway Design

Sir: In regard to the recent Elevated Highway Competition I would like to say that I am entirely in agreement with Bernard Holman's letter published in your April 21 issue, p. 652.

Analyzing the other winning designs I found that a great percentage of these had structural and economic faults. I found also, that each of the winning designs was very well presented, the coloring and rendering of the various prize schemes was quite artistic.

A complicated problem such as this should in my mind have been judged for months, but the results were announced a few days after the closing of the competition. It was a physical impossibility to judge the merits of each problem submitted in so short a time. Each design submitted should be judged thoroughly, not only in fairness to the competitor, who spent months preparing his pet idea, but also to the profession at large who are searching for new ideas through the medium of such competitions.

My reactions were that in the future, the jury should be composed of fewer members with national reputations. Time should be given the jury so that each drawing could be analyzed from all points of view. If these points were carried out I am quite sure that there would be fewer pretty pictures amongst the winners of future competitions.

On the whole, the competition showed that the elevated highway from an engineering point of view is far from solved. The design of the elevated highway gives the profession a field so fertile that all effort should be extended to reach a satisfactory solution.

HENRY CONRAD EIPEL
New York, N. Y., April 26, 1938

Beam Shear and Net Area

Sir: Referring to the interesting article on beam shear, by Messrs. Mount and Welch, (*ENR*, April 14, 1938, p. 546), may I point out in further support of their conclusions that if the scale on the shank were only 0.002 in. thick, the adjacent steel would have to compress 0.001 in. to bring the parts in contact, assuming that the scale would crush readily. To deform the steel 0.001 in. per in. would require a unit stress of 30,000 lb. The writer has examined many cut out rivets, and has yet to see one that did not have some scale on the shank. The effect of scale is practically negligible, however, when cooling shrinkage is considered.

Assuming that the temperature of a rivet shank is at least 1500 deg. F. when fully driven and that the shank of a rivet is so perfectly upset as to fill completely a 15/16 in. diameter hole, the shank will shrink about 0.009 in. in cooling. This will be increased by the reduction of diameter (Poisson's ratio effect) caused by cooling strain parallel to the grip. In order to close the gap between 4, 5 and 6, that no less an engineer than the late Gustav Lindenthal contended that rivet shanks cannot be correctly assumed to fill the holes (*Trans.* Am. Soc. C. E., Vol. 83, p. 1635), and designed the compression members of as important a bridge as the Hell Gate arch on the basis of net section. (*Trans.* Am. Soc. C. E., Vol. 82, p. 914). It is recognized and admitted, furthermore, by those who have had experience in driving long rivets, such as those in the gusset plates of heavy trusses, in the splice plates of long columns, and in thick flanges of heavy plate girders, that long rivets do not completely fill the holes. The writer has found that this was also true of short rivets.

The use of steel plugs having a driving fit does not duplicate the effect of rivet shanks, as such plugs will fill the holes more completely than rivets, and the writer would suggest that in any future experiments the effect of rivet shanks could be more nearly duplicated by driving rivets through the web, with washers on each side, and cutting off the heads, leaving the shanks in place.

In the discussion by Mr. Lindenthal cited above, it is pointed out the rivet and the hole, the adjacent steel would then have to be stressed beyond the yield point, as a deformation of only 0.001 in. would stress the metal to 33,000 lb. per sq. in.

Although the writer regards the assumption that rivets fill the holes as a rather convenient fiction, he does not by any means believe that existing unit-stress and design formulas can be applied to net sections without revision. A comprehensive review of column test data on the basis of net section (and also on the basis of the thickness of the metal used, which is another matter) would probably add considerably to our knowledge of columns. Concerning the flexural design of plate girders, the writer believes that the use of gross section is more nearly correct than net section for computing the unit stress between cover plate rivets, but that an appropriate formula should be devised for computing the average increase in stress through the rivet holes. This opinion is based on analysis of deflection measurements made on a large number of railway girder spans.

Concerning beam and girder webs, the writer shares the opinion of other engineers, that they are much stronger than our current approximate method of design indicates. This opinion is based on inspection and office check of many existing railway girder spans now carrying much heavier loads than those for which they were designed. The problem is not as simple as merely dividing the net reaction by the web area, and probably would be better answered in terms of diagonal tension and compression. However, since the average vertical unit shear will probably continue to be used for some time as the criterion of web strength, consideration should be given to increasing the allowed unit stress and using the net section of the web, as indicated in the article under discussion.

THEODORE DOLL
Structural Engineer
Chicago, April 22, 1938

Nicaragua Canal

Sir: The letter of Mr. Randolph on p. 563 of your issue of April 21 commenting on my letter does not take a full view of the subject. My letter was written in view of the statements contained in an article giving the arguments in favor of building a canal at Nicaragua. It is perfectly evident that the points on a canal open to a bombing attack are the locks and the fewer the locks the least exposed the canal is to damage. To drop sufficient bombs on a hillside such as the slopes of the Culebra cut, to throw enough material into the canal prism to block it would be practically impossible especially if a very flat slope was given to banks. This would involve moving a great deal of material of course but there is no reason why it is not practical. With the storage dam now built on the Chagres it should be possible to keep the flow from this river either entirely diverted from the canal or allowed to enter in a way that would not create strong currents. If necessary the construction of a tidal lock at Balboa would not present anywhere near the target that the present numerous locks do. It could be built in duplicate so as not to be all damaged by one bombing.

A sea level canal would be so much less exposed to damage from bombing than a lock canal that it seems that instead of spending several hundred millions on another lock canal, which would easily be put out of working order at the same time as the one at Panama, it would be better to put that canal in a condition that would be practically impossible to damage it by any air raid. Of course any enemy nation that obtains the control of the sea over us would land an invading force at either or both canals which is a good argument for a navy strong enough to meet any possible combination of forces that can be brought against us.

Robert S. Smith
Biloxi, Miss., April 24, 1938

Strain Gage Calibration

Sir: The constantly increasing use of strain measuring instruments such as tensometers and dial indicators has made it imperative that satisfactory and acceptable methods of calibration for those instruments be devised and made known to the users of that kind of apparatus. "Strain Rosette Technique" by George E. Beggs and Elmer K. Timby in the March 17, 1938 issue discloses an interesting method for calibrating tensometers. The method undoubtedly possesses merit, but what is believed to be a simpler method has been in use by the Aluminum Research Laboratories for several years. The method and apparatus which we use have the advantage of being readily adaptable to the calibration of other kinds and types of strain measuring devices such as dial indicators and extensometers.

The apparatus set up for calibrating tensometers is shown at the left in the accompanying illustration. This device is described fully in a paper by R. L. Templin entitled: "The Calibration of Extensometers" (A.S.T.M. *Proceedings*, Vol. 28, Part II, pages 714–727).

Essentially it consists of a calibrated differential micrometer screw shown at the right end, a telescoping tube and piston for mounting the apparatus shown at the left end, and the necessary connecting lever attached by means of plate fulcra, all suitably mounted on a cast iron base. One complete revolution of the graduated disk attached to the micrometer screw represents 0.001 in. movement of the piston with respect to the tube, and the least graduation of the disk represents 0.00002 in. movement.

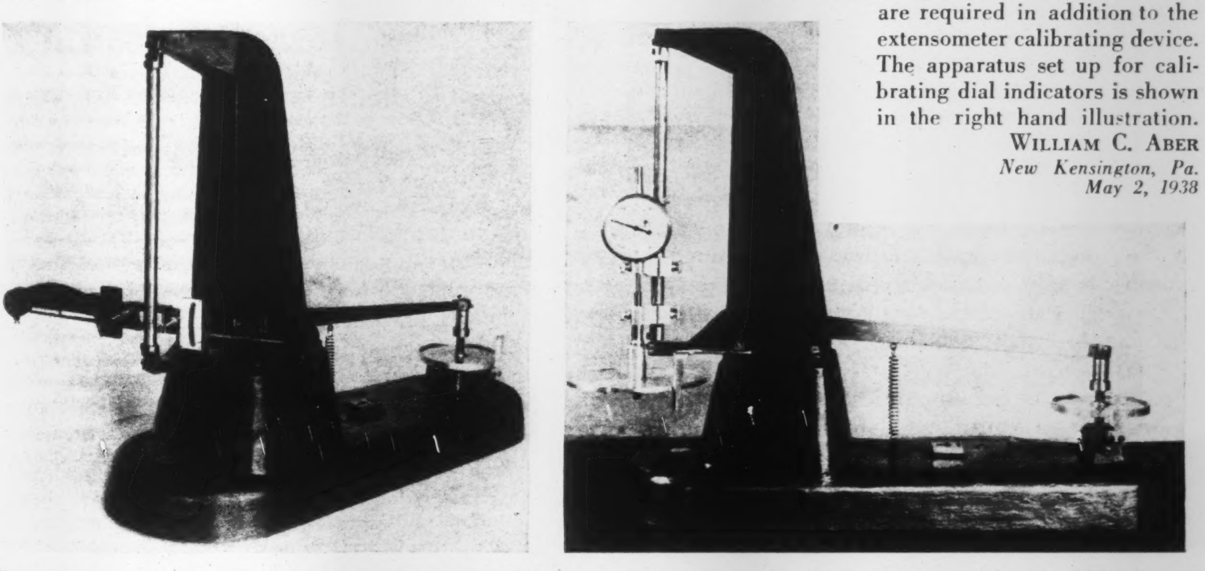
For calibration, tensometers are usually mounted in pairs as shown, and their magnifications are calculated by comparing the changes in readings of the tensometers with the displacement of the piston with respect to the tube as shown by the readings of the graduated disk.

The differential micrometer screw was calibrated by the National Bureau of Standards and was found to have an error of 0.3 per cent, which is taken into consideration when the results of the tests are being computed.

Practically any type of extensometer or compressometer having gage length of from about 1/10 to 10 in. may be calibrated on the extensometer calibrator just described, provided, of course, that their overall dimensions do not prohibit their being mounted on the device.

For calibrating dial indicators, special adapters for mounting the indicators and an auxiliary micrometer caliper head with attachments are required in addition to the extensometer calibrating device. The apparatus set up for calibrating dial indicators is shown in the right hand illustration.

William C. Aber
New Kensington, Pa.
May 2, 1938



Extensometer calibrating device arranged for the calibration of extensometer in the left hand view and for the calibration of dial indications at the right.

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Editorial Offices at 330 West 42nd Street, New York

MAY 12, 1938

TWO STATES, Kentucky and Rhode Island, since the first of the year have joined states having engineer license laws, leaving only eight states without some form of law regulating the practice of engineering. In most of the states that have passed license laws recently the approved law follows the model law quite closely, but in many other states the existing law is full of defects that must be eliminated by the slow process of amendment. In New Jersey the old law was found so defective that an entirely new law has been placed before the legislature by the engineers of the state. Such revision of the laws, whether by complete rewriting or by amendment, is a natural process which calls for and should receive more than superficial attention on the part of engineers. The early laws frankly were compromises; desirable elements had to be left out to avoid too much opposition, or else undesirable clauses had to be added to meet the demands of strongly intrenched foes. Now that registration is approaching national acceptance these weaknesses can be eliminated and the laws made to conform to what is known to be needed. This is no work to be done in haste during a legislative session; it is work that should be done with careful forethought.

Bottlenecks in Water Systems

WHAT ARE THE FACTS regarding the physical condition of municipal water services? Addressing itself to the question of air-conditioning demands on water supply, a panel discussion at the recent American Water Works Association convention brought forth some illuminating answers concerning waterworks systems in general. The most comprehensive information came from O. C. Holleran of the U. S. Department of Commerce who reported on studies made in 434 cities. The danger of over-demand due to air conditioning which appeared so serious a year ago has been markedly reduced, due in part to the development of water-conserving types of equipment. What the survey did reveal as being still a matter of major concern is the unbalanced condition of so many water systems. It was found that where distribution mains are adequate in size the pumps may be too small, or where these facilities are adequate the treatment-plant capacity may be deficient. In other words, "bottlenecks" exist, and before greater demands can be met these must be eliminated. This should point a moral to our cities: Study your water system to discover its deficiencies and then remedy them as fast as money can be made available. A service so vital as water supply calls for the best in physical plant and the maximum possible operating efficiency.

What Makes an Expansion Joint?

UNSATISFACTORY EXPANSION JOINTS are so common in all types of engineering structures that the design of these important devices is always a subject for study. When a design works as its designer intended, it is worthy of praise as well as study. One such design, for a concrete tank, is described in this issue in the hope that the elements of which its success is compounded may be discovered and utilized elsewhere. And "discovered" is the proper word, because the reason for the success of this joint, which has been functioning perfectly for five years, is no more apparent than was the cause of failure in the case of many joints that have not functioned properly. Does the success formula require the inclusion of more laboratory and model studies? Does it suggest simplicity as a characteristic of design? Is more complete knowledge of materials behavior a necessity? Or is it all a matter of luck? Bridges, buildings, retaining walls, roadway slabs, dams, sewage tanks and reservoirs are among the engineering works that suffer from expansion joints that do not expand or are deficient in some other important respect. Engineers concerned with any of these structures have reason to place design of the expansion joints high on the list of difficulties to be overcome.

Teach or Write?

THE DESIRE for institutional publicity is having a curious effect in some of our engineering schools: ability to write acceptable papers is placed above ability to teach. Young instructors are told that their continuation on the teaching staff will depend in large measure on the articles they get published in technical journals and on their papers accepted by technical societies. Whether they can impart their knowledge to the student assigned to them appears to be a secondary consideration. Ability to write clearly and concisely may be considered by those who have inaugurated this system of measuring the value of young instructors to be evidence of ability to teach; and it may be that they also think that the study or laboratory research necessary to produce an acceptable paper stimulates the young instructor to greater effort and so makes his knowledge of his subject more complete. All of this may be true; but it leaves out of consideration the fact that technical journals and technical societies normally are so overloaded with papers of the type that young college professors can write as to make it necessary for them to turn down good papers. Thus acceptance is in part a matter of chance, and the young tutors become victims of conditions beyond their control.

Across State Lines

LATE IN APRIL the U. S. Supreme Court upheld a compact between the states of New Mexico and Colorado for apportionment of the waters of the La Plata River, reversing a finding of the Supreme Court of Colorado; and in doing so the Supreme Court gave emphasis to the great possibilities of interstate agreements in providing for the solution of problems that reach across state lines. Such compacts, the court said, find their origin historically in the treaty-making powers of sovereign states, hence once they have been signed by the states concerned and have been approved by Congress their provisions become superior to local statutes that might otherwise be invoked to nullify them.

Despite this fact the history of most interstate compacts drawn in the past to control the use of our natural resources has been disappointing. Few have been full executed. The Colorado River compact has not yet attained full acceptance and the Delaware River compact failed completely. In more recent time we have seen the proposed compacts for control of floods on the Connecticut and Merrimack rivers held up at the instigation of a federal bureau after the states concerned had come to an agreement.

Can more be done to simplify the negotiations and adoption of interstate compacts? One answer may be found in the Flood-Control Act of 1936. That act, by providing for liberal federal contributions to the cost of work covered by the interstate agreement, indicates the way in which Congress can facilitate the consummation of interstate agreements against the opposition of a single state. No state can be compelled to enter into an agreement with an adjoining state, but the prospect of federal aid in carrying forward a much-desired project should aid greatly in causing state officials to take a broader view than that of narrow self-interest.

And it is logical to provide for federal contributions to the cost of interstate operations, since a definite national interest is present in nearly every case. Flood control on interstate rivers is an example, stream-pollution abatement even more prominently so. In the case of regulatory problems common to several states the national concern is unmistakable. To recognize this nation-wide public interest by federal money participation is a simple means of bringing about harmony of purpose.

But an even more direct way to simplify interstate compacts lies in the adoption of a basic federal statute that would define the scope and terms of such compacts. Such a statute might declare valid any agreement kept within the limits laid down, making it unnecessary to wait for subsequent ratification by Congress. As a matter of fact this method has already been used, for the 1936 flood-control act contains a clause giving advance approval to any interstate agreement limited to certain objectives. That the clause in question has not been very effective may be due to its narrow scope. A broader basic enabling act of similar kind, however, would go a long way toward removing the obstacles that now stand in the way of effective interstate action.

Enact Regular Federal Aid

THE CALL TO CONGRESS by Representative Cartwright to pass the regular federal-aid authorization act is a call for action that should be taken at once in the interest of stabilizing public-road improvement. The amount of money required is moderate as viewed by road transport needs; it is a return to roads of a part only of the federal taxes on gasoline and motor vehicles that are paid yearly by road users. But regardless of the money amount, regularization of federal support is vital to sound highway planning by state highway departments.

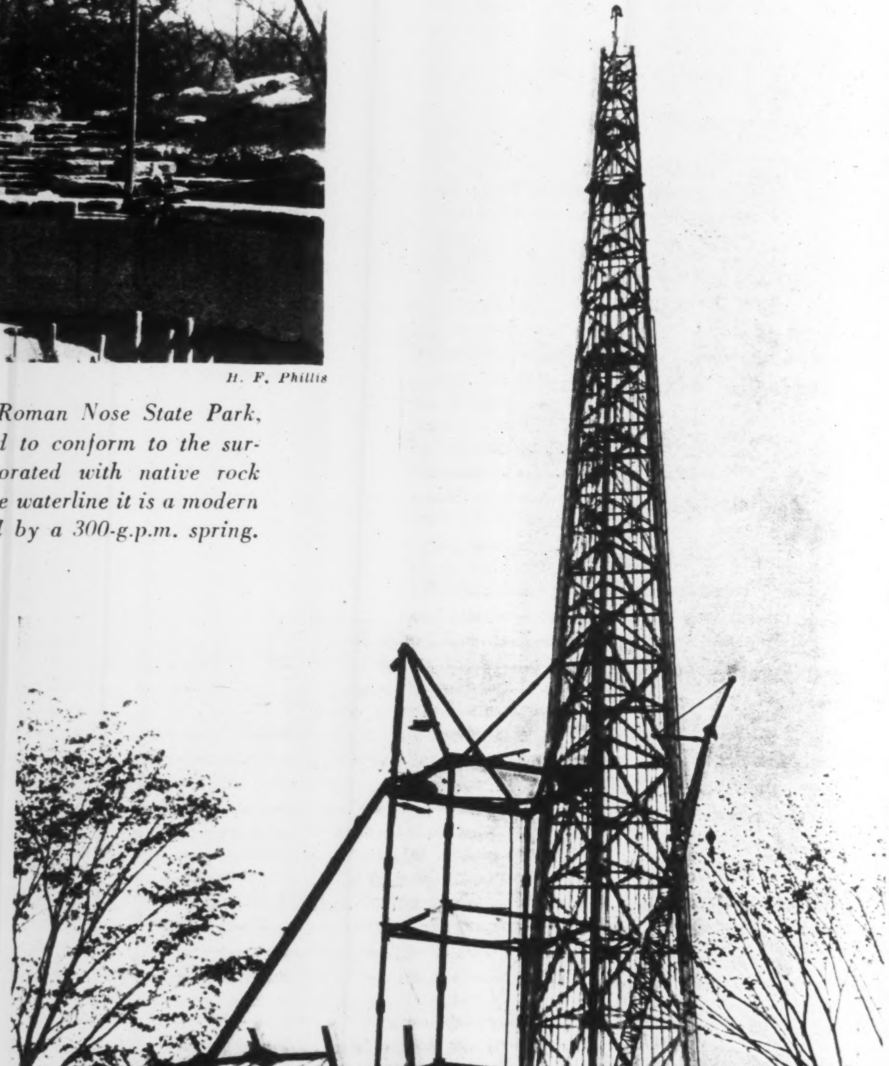
The advance commitment of Congress to federal-aid authorizations a long two years ahead permits state highway officials and legislatures to undertake route and system planning and to prepare for state participation in the financing. This cannot be done when there is no certainty from year to year as to the amount of federal help. No better evidence is needed than the delay caused by President Roosevelt's request to Congress last fall that it rescind the authorization for the coming fiscal year and place future authorizations on the uncertain basis of executive allotment

Congress failed to make the asked-for change, but while Congress deliberated hundreds of highway plans were held up and today road work in every state is months behind planned schedules. This can be avoided by the well-proved plan of authorizing expenditures two years in advance of actual expenditure. Congress should enact at once the federal-aid authorization now before it and keep roadbuilding on the stable businesslike basis that has made it a credit to public-works administration.

PICTURES IN THE NEWS

H. F. Phillis

A SWIMMIN' HOLE for Roman Nose State Park, near Watonga, Okla. Shaped to conform to the surrounding terrain, it is decorated with native rock above the waterline. Below the waterline it is a modern reinforced concrete pool, fed by a 300-g.p.m. spring.



THEME STRUCTURES for New York's World's Fair as they looked last week. The "Trylon" tower lacks about 100 ft. of its 700-ft. total height, while the framing for the 200-ft. diameter "Perisphere" is just nicely started. Both structures are to be enclosed in stucco walls.

Wide World Photo

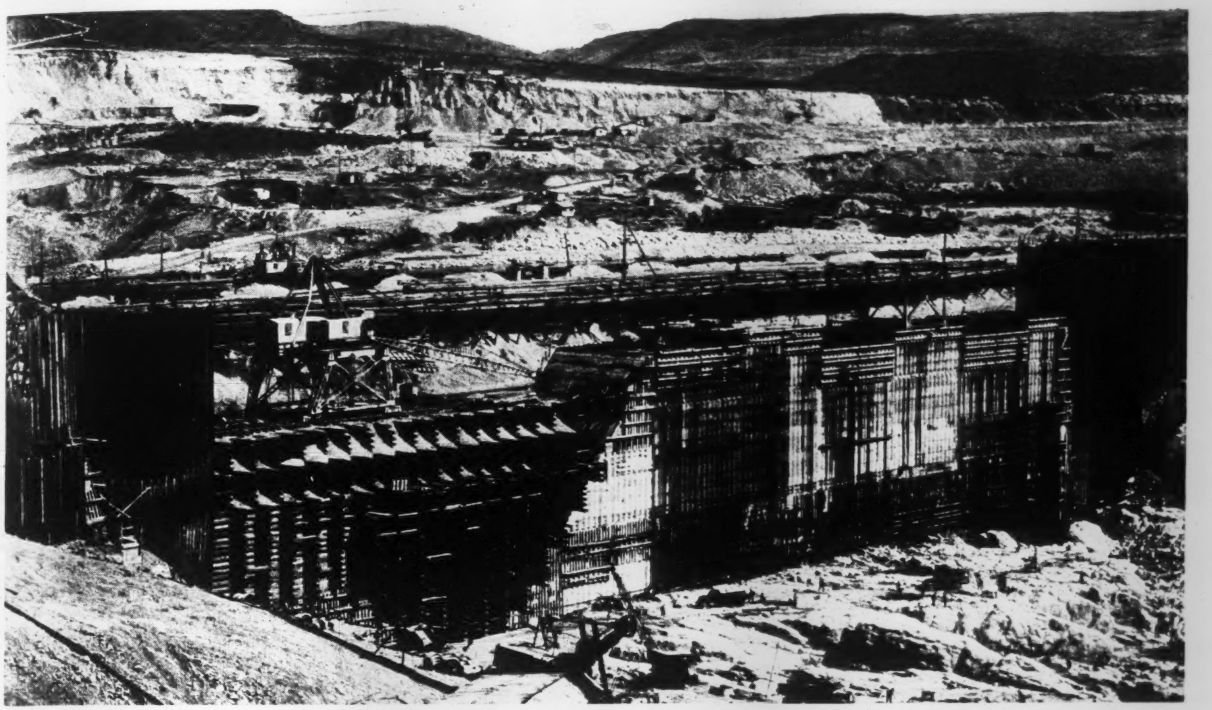


FIG. 1. EAST-SHORE COFFERDAM AT GRAND COULEE DAM ENCLOSING SIXTY ACRES OF RIVERBED

Wrenching Out A Cofferdam

ROBERT J. JENKS
Assistant Engineer M.W.A.K. Co., Coulee Dam, Wash.

Pulled and battered apart piecemeal, the tough walls of the last cofferdam are now gone from the Columbia at Grand Coulee dam

FREE OF COFFERDAMS, the Columbia River is now flowing through its appointed temporary channels at Grand Coulee dam. Demolition of the last steel and timber and earth enclosure of 60 acres of river bank and bed has been completed. It proved to be one of the toughest tasks involved in construction operations that have set many records of magnitude and difficulty. The units of the coffer walls were so solidly founded and closely interlocked that they had to be actually wrenched to pieces. And this slow work had to proceed downward in stages following a falling river and going under water at last for the final clearance. In these ways three-quarters of a million cubic yards of material had to be removed from the path of the river.

Two cofferdams were employed to lay dry the site for Grand Coulee dam, one reaching out from each shore to about the middle of the river. The inclosure from the west shore was built first and when it was no longer needed it was torn out and such salvaged material as could be was used in building the east cofferdam. This is the structure recently torn down and it is clearly shown in Fig. 1. The dam consisted of the conventional two shore arms and a river wall.

The river wall was made up of several types of structure. A principal part was the end section of the concrete dam (Block 40) built within the west cofferdam. Block 40 was of course formed to the rollway face and spillway-bucket curves as indicated by Fig. 2, and this space was filled with a timber crib. The ends of the river wall were sheet pile shells. The cribwork is structurally the unusual part. It had a top width of 93 ft. and a maximum height of 120 ft. and was virtually wedged and sealed into the hollow of the spillway bucket.

The shore arms were timber crib structures with an inside supporting berm, an outside protective fill and a steel sheetpile cutoff wall attached to the cribs. A typical section is given in Fig. 3. The width of the cribs varied from 45 to 90 ft. depending on the elevation of the river bed; the shore ends consisted of a steel sheetpile cutoff wall with a timber backwall to hold a fill. The inside and outside fills of the upstream arm were both of gravel on rock and an attempt was made to keep the rock level below El. 930 so that it would not have to be removed in the dismantling, but the fills around the downstream arm were of gravel alone as they had to be entirely removed. The *D* and *G* cell clusters were remnants of the west cofferdam, but the steel-pile cells tying into the crib section and into Block 40 were parts of the second cofferdam. A serious leak early in 1937 threatened to flood the enclosure and a group of repair cells was constructed (*ENR* April 22, 1937, p. 595) to support the *G* Section.

These then were the structures to be demolished. They had been made sturdy to resist the flow of a turbulent river and insure the safety of costly work operations so that demolition was not easy. This was stipulated by the U. S. Bureau of Reclamation to be: (1) removal of the upstream arm from El. 1,000 to El. 930; (2) lowering cell clusters *D* and *G* from El. 1,000 and 990, respectively, to El. 950; (3) complete removal of the rollway and spillway-bucket cribwork, and (4) removal of the downstream arm to the original riverbed.

Stage removal adopted

Besides being the natural procedure, demolition from the top downward by stages was the course indicated by time conditions. To have ample time and to do as much as possible in the dry the work had to start with a falling river and to follow the drop downward to the final low water. Also the condition required for final flooding indicated a rather uniform rate of cutting down all along the cofferdam wall. In general these were the plans followed.

First Phase—As soon as the flood peak passed in the summer of 1937, and the river showed a definite falling trend, progressive dismantling of the cofferdam started. The sheetpile walls on both the upstream and downstream arms were cut at the top of the outside fills and removed. The 4- and 5-cu.yd. electric shovels then ripped up the top sections of the cribs and loaded the materials into trucks for disposal. This brought the upstream arm down from El. 995 to El. 970 and the downstream arm from El. 990 to El. 960. The shovels next excavated the top of the fill outside the upstream arm to El. 960 and the supporting fill of the downstream arm to El. 940. The plan in this work was to keep a balance between the capacity of the excavating crews and the rate of drop in the river. Excavation of material in the *G* cell cluster and in the crib followed the work on the downstream arm as each succeeding level formed a road over which the trucks could haul excavated material.

In the next step the contractors went just as far as possible without danger of flooding the working area. The crib structure and the outside fill of the upstream arm were excavated to El. 950 and work began cutting the inside fill down to the final elevation of 930. The sheetpiling, however, was left at El. 965.

By this time the river had dropped enough to permit the removal of the repair cells and the inside supporting fill for the downstream arm. This cleaned up the inside area on the downstream side of the dam, and the construction of the bucket section of the spillway was completed in the area previously occupied by the repair cells. At the same time the crib structure was cut down on both the downstream arm and over the spillway bucket; also the outside fill was excavated to the same level and the sheetpiling was cut off.

Second Phase—At this stage the work of removal had covered the period from July to October, 1937. Exceptionally heavy rains in October threatened to raise the river enough to top the levels at which the cofferdams then stood. As this high flow continued all fall further excavation in the dry had to be postponed until the area was ready for flooding.

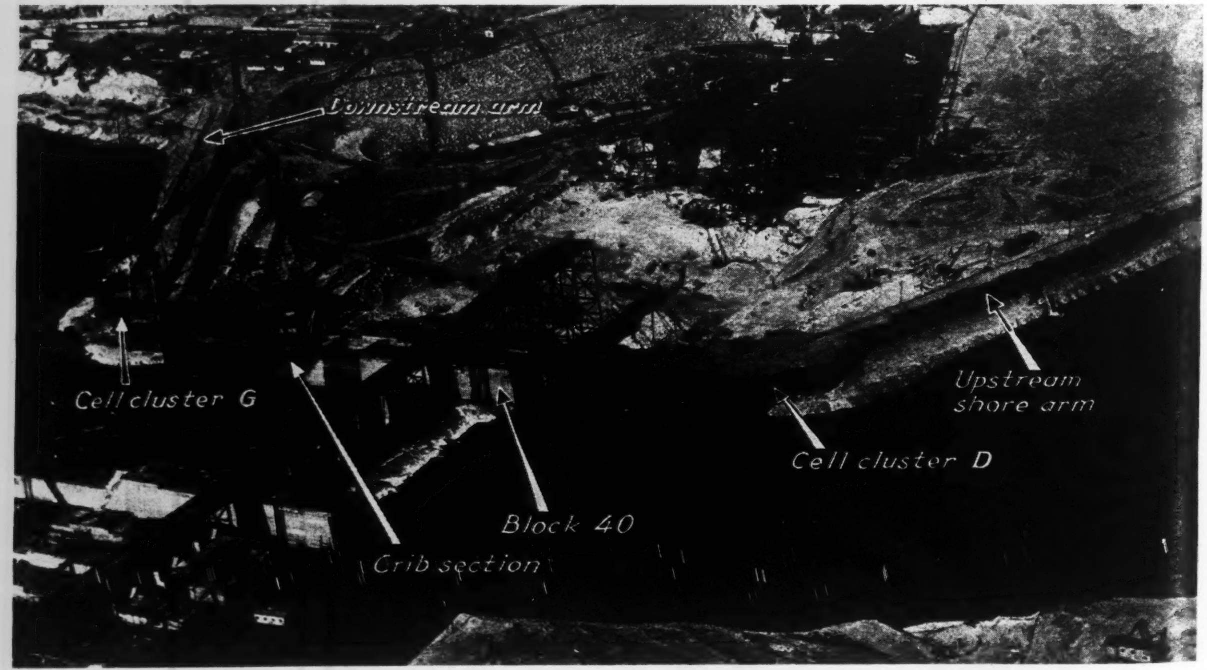


Fig. 2. A filled timber crib built against the sloping downstream face of Block 40 and carried down into the curve of the spillway bucket formed part of the river wall of the east cofferdam.

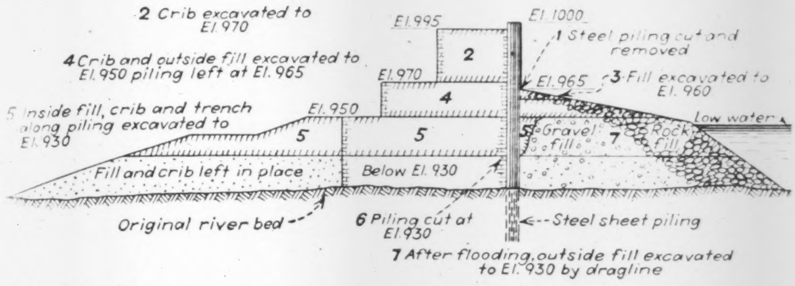

2 Crib excavated to El. 970
4 Crib and outside fill excavated to El. 950 piling left at El. 965
5 Inside fill, crib and trench along piling excavated to El. 930
El. 995
El. 1000
1 Steel piling cut and removed
2
El. 970
4
El. 965
3 Fill excavated to El. 960
El. 950
5
5
Low water
5 Gravel fill
7
Rock fill
Fill and crib left in place
Below El. 930
Original river bed
6 Piling cut at El. 930
Steel sheet piling
7 After flooding, outside fill excavated to El. 930 by dragline

Fig. 3. **Full-depth removal of the upstream shore arm was not required; the numerals indicate the order in which the parts were removed.**

The downstream side was flooded first, on Nov. 25, and draglines immediately started removing the cribs next to the *G* section. As the *G* section had previously been excavated to original ground elevation of 950, a road connection was no longer required. As fast as the draglines removed the crib structure and the outside fill, floating equipment moved in to pull the steelpiling driven into the clay of the river bed. This piling had been salvaged from the first stage cofferdam and many of the pieces had required splicing before they were driven the second time. The failure of many of these splices finally required the development of a pile puller that would reach below the water and get a firm grip on the steel pile web. This device will be described in a subsequent issue.

The clay, being very dense, held the piling firmly which, together with an unusually high fall flow of the river, made the work more difficult than expected. Grout and bentonite from the pressure grouting of the old leak in the *G* section had filled the interlocks of the sheetpiling, further increasing the task of pulling the piles. In some sections there was resort to blasting in drilled wells in an endeavor to loosen the piling.

As water level was below the top of the concrete when the downstream side was flooded, it was possible to start removal of the downstream arm before all construction on the upstream face of the concrete dam was finished. Thus it was possible to have a channel ready for the river by the time the upstream side was flooded.

The fact that the upstream arm had to be excavated only to El. 930 instead of to the original river bed, made the work much easier than it was on the lower arm. Excavation was carried down to this level on the inside supporting fill and the crib structure just before flooding. At the same time a narow trench was dug outside the sheetpiling and the seepage was allowed to drain into the construction area. The piling was then cut off at El. 930 and removed in the dry. The final step in removing the upstream cofferdam was the excavation of the outside fill by dragline and clamshell. Part of the material removed was placed in a fill against the face of the dam. This fill started at El. 900 well below the intakes to the outlet tubes, and sloped up to the final cofferdam level of El. 930 on a 4:1 slope. All supporting toe cells inside the *D* section were cut on this slope. These cells were emptied by cutting holes in the piling at water level and sluicing the material into the river channel where it was carried away by the current. When the cells were emptied the piling was cut at El. 950 and below this level the piling was left in place.

The last tough task.

Tedious and difficult as was the work of removing the shore arms, the cribwork in the spillway bucket proved a tougher nut to crack. As previously stated, this structure was wedged and partly cemented into the hollow of the rollway and bucket. The crib and fill were excavated to water level by power shovels and the material was trucked out; below water the fill was gravel and stone in some sections 70 ft. deep and parts next the concrete had been grouted.

The original plan for dismantling was to empty the crib pockets completely in the hope that the wood structure would then float out, but after clamming out as much material as could be removed the crib still remained in place. The next move was to load a barge with several hundred tons and to use it as a battering ram in an endeavor to jolt the crib loose. This plan succeeded in breaking out a major portion of the crib; clamshells cleaned up the remainder.

The total fill removed from the second stage cofferdams was 749,000 cu. yd. Of the 7,602 tons of sheetpiling used in the job 4,242 tons were removed and 3,360 tons were left in place. The crib in the spillway bucket contained 3,000,000 ft.b.m. of timber and the two cross river arms contained a total of 10,500,000 ft.b.m. Dismantling started in July, 1937, reached a peak in September and October and thereafter continued on a greatly reduced scale until February, 1938.

The Grand Coulee Dam is being built by the U.S. Bureau of Reclamation, R. F. Walter, chief engineer; Frank A. Banks, construction engineer at Grand Coulee Dam. The contract for the first stage of the work involving 4,525,000 cu. yd. was carried out by the M.W.A.K. Co., C. D. Riddle, job manager and chief engineer.

• • •

Sewage Gas Hazards

IN A GAS COLLECTION incident at the sewage works of Monmouth, Ill., the operator had taken down a condensate trap for servicing, and while scraping out a harmless-looking black material he felt a spark on his arm. He started to blame his helper for smoking while at work on the gas system, but the latter pointed to the heap of black dirt, which was then a glowing mass. This material was apparently iron sulphide, which may be produced when hydrogen sulphide attacks iron or steel. It oxidises in the presence of air and sufficient heat may be generated to cause ignition. Another incident occurred at Macomb, Ill., where the operator found his digester gas production had decreased. He lit a match in the basement of the service building and was greeted with a flash of flame, which fortunately did no damage. It was found that the gas line outside the building had settled and opened slightly at a joint, the gas then leaking along the pipe into the basement. Accidents of this kind are said to have had serious consequences at several sewage disposal works. Both of the above occurrences are reported in *The Digester*, published quarterly by the Sanitary Engineering division of the Illinois Department of Health.

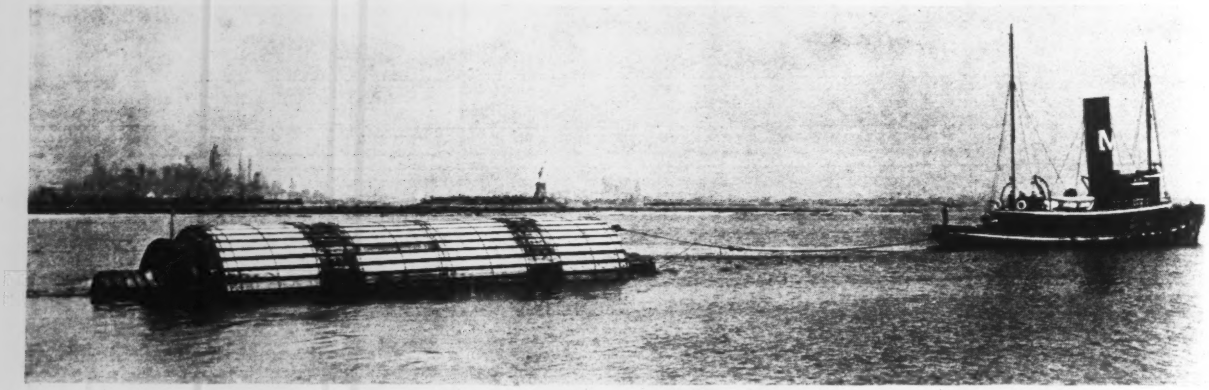


FIG. 1. STARTING TO TOW A 15X80-FT. 230-TON STEEL CYLINDER FROM NEW YORK HARBOR 1300 MI. TO CHICAGO

Special Rig Docks 230-ton Still

G. F. Bayes

Manager, Construction Department, the M. W. Kellogg Co., Jersey City, N. J.

Oil still too large to be transported by rail towed to East Chicago and hoisted from water with improvised equipment

Early last year an especially complicated problem of transportation and erection was presented to the writer's company. At the Standard Oil Co. plant at Whiting, Ind., the process department required an evaporator tower 15 ft. in diameter, 80 ft. long, and weighing 230 tons. In addition to this vessel there were to be six coke drums 16 ft. in diameter and 60 ft. long, weighing about 85 tons each. These were being fabricated at Jersey City, N. J.

The tower was too large and too heavy to be shipped on any railroad or on any boat, which made it obvious that the only way that it could be fabricated in Jersey City and transported to Whiting, which is at the southern end of Lake Michigan, was to seal it thoroughly, place it in the water and tow it up the Hudson River, through the Barge Canal and the Great Lakes, a distance of about 1,300 mi. to the Standard Oil Company's docks at East Chicago, Ind. This indicated a like procedure for the coke drums.

Suitable equipment was available at Jersey City to place these vessels in the water, in the shape of the world's largest floating derrick. On the other hand, the construction department's problem of removing the tower and the six coke drums floating in the canal at Whiting and loading them onto suitable cars 10 ft. above the water was not so simply solved. The plan which was finally adopted was as follows.

Two steel A-frames 24 ft. high were erected. (Figs. 2 and 3). Each was mounted on three 21-in. I-beams

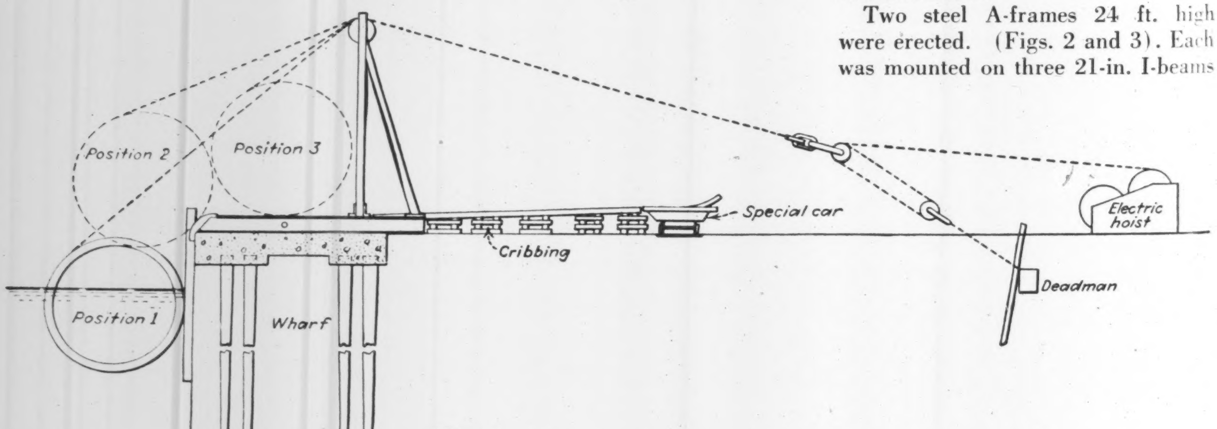


Fig. 2. Schematic arrangement for raising 230-ton floating cylinder to dock level and for loading it onto cars.

26 ft. long. These A-frames were placed 31 ft. apart and parallel to the edge of the dock, the vertical legs of the frames being located 20 ft. back from the edge. Fourteen piles were driven in a nest and capped in concrete to form a foundation for the frames, and the three 21-in. I-beams were bolted to the concrete. The dock ends of these beams were fitted with special blunt nose castings which served the double purpose of acting as cable guides and giving a rounded corner to the edge of the dock over which the load could ride easily without suddenly imposing a severe strain on the lifting cables or the hoists. The accompanying diagram (Fig. 2) shows the A-frames mounted on these I-beams.

Two 24-in. sheaves

At the top of each A-frame were two 24-in. cable sheave wheels over which run the 1⅜-in. cables used to raise the load. Each of the lifting cables was 450 ft. long. These cables were doubled and had their free ends anchored at the base of the A-frame to the 21-in. I-beams. The cables were then passed over the edge of the dock in grooves recessed in the nose castings, down around the cylinder and up over the sheave wheels in the top of the A-frame and to the rear, a distance of some 50 ft., to a single sheave equalizer.

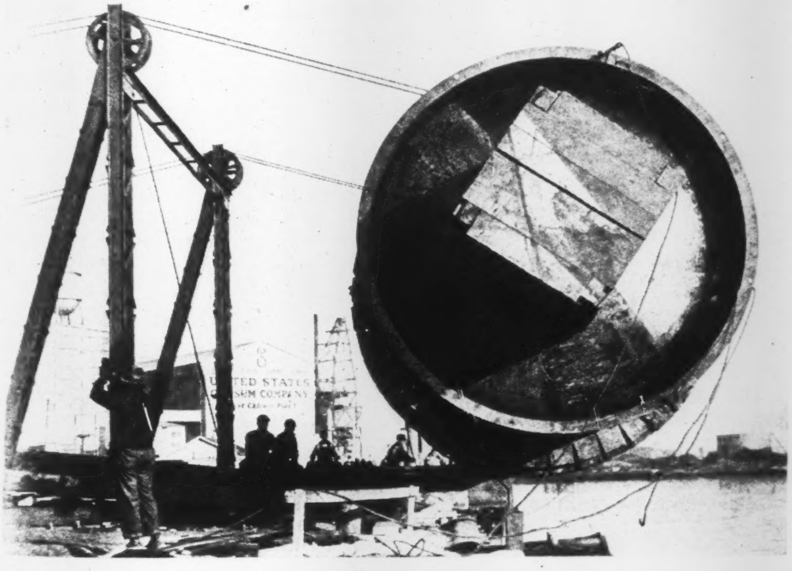
Two sets of six-sheave blocks were reeved up, the load blocks being attached to the equalizing sheaves, the opposite blocks secured to dead men and the load lines attached to the hoists. Each hoist had a capacity of 22,000-lb. single-line pull which afforded ample power for rolling the tower up the face of the dock. All stresses involved in this method of procedure were carefully calculated and the equipment and rigging were built accordingly. The sketch illustrates the general layout and the accompanying view shows the equipment in actual operation.

Lift made in 90 sec.

The weeks of careful study and preparation paid dividends in the form of a perfect lifting operation; 90 sec. after all slack had been removed from the cables the 460,000-lb. vessel was resting on the dock, and the riggers were preparing to dismantle the A-frames.

Existing trackage at the dock was rechecked and a specially ballasted spur was laid to the face of the dock joining the plant track system on a 16 deg. curve. Special cars were used in tandem to transport the 80-ft. vessel to the job site: the load was carried on bolsters so located as to reduce the overhang of the vessel on curves to a minimum.

When the vessel had been landed on the dock and moved to a position just in front of the A-frames, it was securely blocked in position and all rigging and the A-frames were dismantled. This dismantling accomplished, a new dead end for the eyed ends of the cable was utilized which permitted rolling the vessel on wood cribbing to the special cars on the siding. Fig. 1 shows how the tower was lagged with timber to protect the nozzles and manholes in transit and while the vessel was being rolled out of the water to the cars.



ig. 3. **Rolling the 230-ton cylinder out of the water in the bight of steel cables.**

* * *

Circulation of Rainfall Urged in Paper

THIS GENERATION finds itself confronted with the task of planning hydraulic works that are to endure a century or more on the basis of hydrological observations covering only a few decades. Has man's occupancy of the earth affected rainfall, evaporation, and run-off, or are the floods of the 1880's and the droughts of the 1930's merely natural variations of hydrologic phenomena that will show still greater extremes within the life of the structures we are now building? In the absence of sufficient basic data, we must plan with moderation and not endeavor to change nature's regime too drastically lest future generations charge us with short-sightedness.

"Surface run-off represents that portion of continental rainfall which is derived from the ocean. If we retard it and cause its repeated evaporation and transpiration, we have the use of it over and over again. Rainfall which is evaporated or transpired really does not represent a loss. It represents the portion of the rainfall which we save to use over and over again.

"So-called evaporation and transpiration losses represent rainfall derived from the land areas. They represent the currency with which we do the business of raising crops. We should keep this currency in circulation. Once it returns to that central bank, the ocean, we have to wait a long time before we get it back. Every farmer can help retard and conserve the run-off and thus turn it into rainfall. Ponds on every farm may well be the aim of water conservation. Similarly, fall plowing, check dams, and soil conservation projects all help to retard surface run-off, and thereby increase the currency of rainfall."—ADOLPH F. MEYER, *in report on Red River of the North, National Resources Committee, 1937.*

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

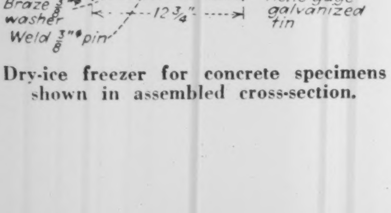
A Dry Ice Freezer

W. B. Ivie
Concrete Technician, U. S. Engineer Office, Winfield, Mo.

A device for freezing concrete or concrete aggregates is shown by the accompanying drawing. The cost, complete, should be not more than $50; it takes no more space than a couple of 12-qt. buckets, weighs about 85 lb., and it can be made in any tin or welding shop. The unique freezing properties of dry ice are utilized and 24 freezing and thawing cycles per day are easily obtained.

The cylinders are placed in the copper container and covered with water and the copper container is covered with a lid and placed in the larger steel container supported by the pin at the bottom of the steel container and by the spacer ring at the top. This assembly is then placed in the insulator. About 4 or 5 lb. of dry ice is broken into small pieces and packed into the space around the container holding the concrete cylinders. Acetone or kerosene is poured over the dry ice until its level is just above the concrete cylinders in the copper container. Care must be used in pouring the acetone or kerosene over the dry ice or it will bubble over. It is only necessary to add about 1 lb. of dry ice per cycle to keep the oil bubbling and maintain it at the desired level.

Although it was demonstrated by tests that the occluded water could be completely frozen in 11 min., it took 26 min. for the cylinders to reattain 70 deg. F. temperature without subjecting them to the shock of extremely hot water. Therefore, as no appreciable saving in time could be effected by freezing them a shorter period of time than it took for them to thaw, a 30-min. period was used for freezing. This also insured complete crystallization of all the moisture.


Handles brazed and welded to container
6" ⌀ steel pipe
Lid
Galv iron top soldered to insulating shell to protect insulating filler
Concrete test cylinders
Steel container to be removable from insulating shell for emptying
Insulation hair felt
18 in.
Copper container
Kerosene or acetone and dry ice
Double walled G.I. Container filled with insulation
Braze 3/8 washer
12 3/4"
No. 16 gage galvanized tin
Weld 3/8" ⌀ pin

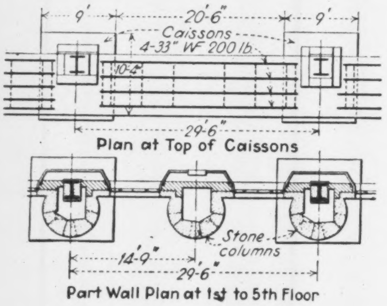
Dry-ice freezer for concrete specimens shown in assembled cross-section.

At the end of 30-min. freezing, the copper container is removed and immersed in hot water to loosen the concrete cylinders. The cylinders are then removed and placed in a tank containing water at 70 deg. F. to thaw and another set of cylinders is placed in the freezer. Thus one complete cycle per hour on two sets of specimens is obtained.

• • •

Ornamental Facia Columns Carried on Girders

Facia columns coming between structural columns are carried on girders spanning between structural column foundations of the new federal court and custom house at St. Louis, Mo. The accompanying drawing shows the arrangement. The columns are hollow limestone 7 ft. in diameter and 60 ft. high. Placed on $14\frac{3}{4}$-ft. centers, there are 36 of these columns, each weighing from 625,000 to 650,000 lb., which had to be supported independently of the steel frame of the building whose wall columns are on $29\frac{1}{2}$-ft. centers.



Supports for heavy stone columns.

Stone columns occur at every steel column and at the mid-point between the steel columns. Caissons sunk to rock at the steel column locations were made large enough to accommodate the stone columns. Groups of 33-in. rolled girders were then set to span between the caissons and pick up a pier at their midpoints on which the alternate stone column was supported.

The architects for the building were Mauran, Russell & Crowell, and the structural engineers Taxis & Becker, both of St. Louis, Mo.

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Cleaning Concrete Surfaces To Ensure Bond

Daniel McFarland
Mason City, Wash.

Large blocks of concrete built in successive lifts at Grand Coulee dam required such large areas of surface to be cleaned for adding fresh concrete that many cleaning devices were tried. Some that have been successful are:

Water-Air Jets — All concrete is required to set 72 hr. before new concrete is added, sprinkling being nearly constant during the curing period. As soon as the concrete has set enough to stand it, the surface is cut with a jet of water and air. This takes off all the particles that are not firmly a part of the concrete. The usual jet is a simple Y-shape nozzle with connections for air hose and water hose. To cover a wider area a head consisting of a piece of $1\frac{1}{2}$-in. pipe with fifty-five $\frac{3}{16}$-in. holes in a length of 18 in. is used. It has $\frac{3}{4}$-in. pipe connections that convey the air and water and also serve as handles. The equipment is mounted on rubber-tired wheels so that the operator can push or pull it over the concrete easily. At first the air and water entered one end only but this caused separation since the water went to the far end and the air came out the near end; when the air was brought to both ends the jet worked uniformly.

Removing White Stain — The water jet washes out a small amount of soluble material from the cement and leaves a white deposit on the surface of the concrete. A thorough washing with an air and water jet and brushing usually gets rid of the thin white deposit but sometimes, and especially if the time between pours is more than three days, sand blasting is resorted to. It was found by covering the concrete with sand after cutting that the cleaning work could be reduced and that most of the white material leached out onto the sand instead of depositing on the surface of the concrete. This was not a complete solution because of the expense of placing and removing the sand and also the interference with the concrete work when the cranes were moving the sand.

Jetting With Power Brush—The next experiment and one that is now being worked out is the use of a power-driven brush for cleaning the surface. A circular brush with steel wire bristles is put on an electric-driven floor sander. It worked fairly well and then an air motor was put in place of the electric motor. The reasons for the change are that the air lines are in and are needed for the air and water jets, the weight is less, and there is less danger to the men than from handling electric wires on the wet concrete. The brush is also equipped with a water connection so that the surface being cleaned will be washed free of the cuttings. The whole is equipped with a handle so that the operator can push it around as required. The apparatus is light enough so that one man can carry it from place to place.

• • •

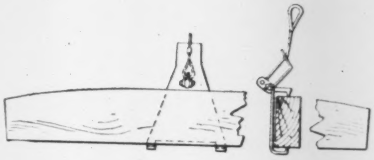
Special Timber Clamp

H. L. Schlubach
Larchmont, N. Y.

When the 54x54 ft. laminated-timber gates for unwatering the low blocks of Coulee Dam were made, over 1,800 pieces of 8x18-in. x 9¾-ft. cut on a 50-ft. radius arch, had to be lifted for drift bolting in place. As it was desirable to push each piece up against the other timbers while still hanging from the crane, slings, end hooks or timber tongs could not be used.

The problem was solved by the device made out of ½-in. plate bent as shown in the drawing.

Through a rectangular hole at the top of the plate a pointed hook protrudes which hinges to the back of the ½-in. plate by means of a ¾-in. bolt held by two small lugs. A ½-in. cable fastened to the other end of the pointed hook and passed from there through a hole in the bent plate, ends in a spliced eye.



Side clamp for lifting timbers.

With the timber segments usually lying flat, the hook tender guides the plate to the center of the segment and lays it on top. He then puts a little strain on the ½-in. cable by hand and signals the crane operator to pick up. The pointed hook at the top and the two sharp edges at the bottom push into the wood and do not release the segment until all the weight has been removed from the cable.

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Soil Mortar Chart

R. W. Miller
Chemical Engineer, Columbia Alkali Corp.,
Barberton, Ohio

In road base stabilization the use of the accompanying chart has been found helpful for rapidly estimating the percentage of aggregate voids and the aggregate-soil mortar ratio. The information needed is the specific gravity and weight per cubic foot of the aggregate and the density in pounds per cubic foot to which the soil mortar will compact. The latter does not need to be determined for rough estimations since soil mortars of good design generally compact to 130 to 140 lb. per cu. ft. This chart will show the amount of soil mortar to fill the aggregate voids. For base construction work that will soon be given a primary surface the quantity of soil mortar to use as shown by this chart should be increased by 10 to 15 per cent and for the construction of roads that are to be left open for a period of time, the amount of soil mortar should be increased at least 25 per cent. The chart is used as follows:

1. Connect specific gravity of aggregate value on Scale *A* and weight of aggregate per cubic foot on scale *B* with a straight edge. At the intersection of the straight edge and scale *C* read the per cent voids in the aggregates.

2. Connect percentage of aggregate voids on scale *C* with the soil mortar density on scale *E* with a straight edge and at the intersection with scale *F* read the pounds of soil mortar needed to fill the voids in 1 cu. ft. of aggregate.

3. By connecting the value found on scale *F* with that used on scale *B*, the resultant density of the mixture after compaction may be read on scale *D*. These scales can only be used for determining the resultant density when the amount of soil mortar is just sufficient to fill the aggregate voids:

$$\text{Density} = \frac{A+B}{1+\frac{B}{C}}$$

where

A = density when just enough soil mortar is used to fill the aggregate voids; B = pounds of excess soil mortar used, and C = density of soil mortar.

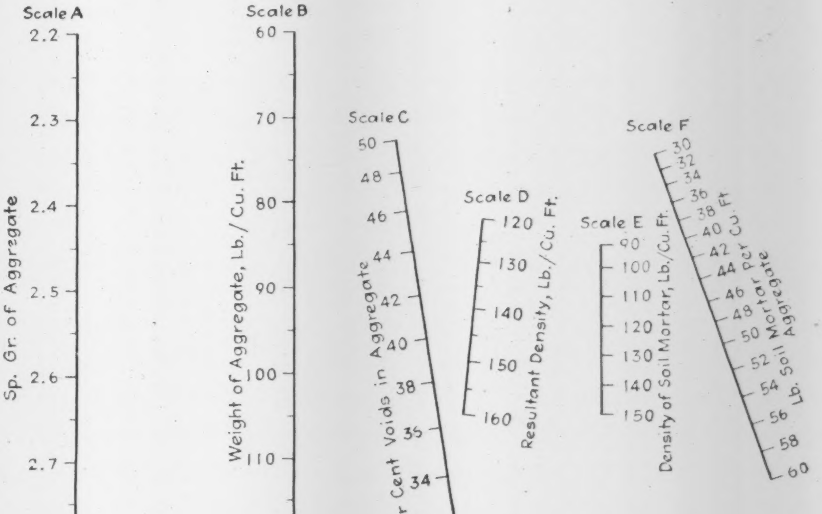

Chart quickly tells volumes of voids and of soil mortar required in soil stabilization.

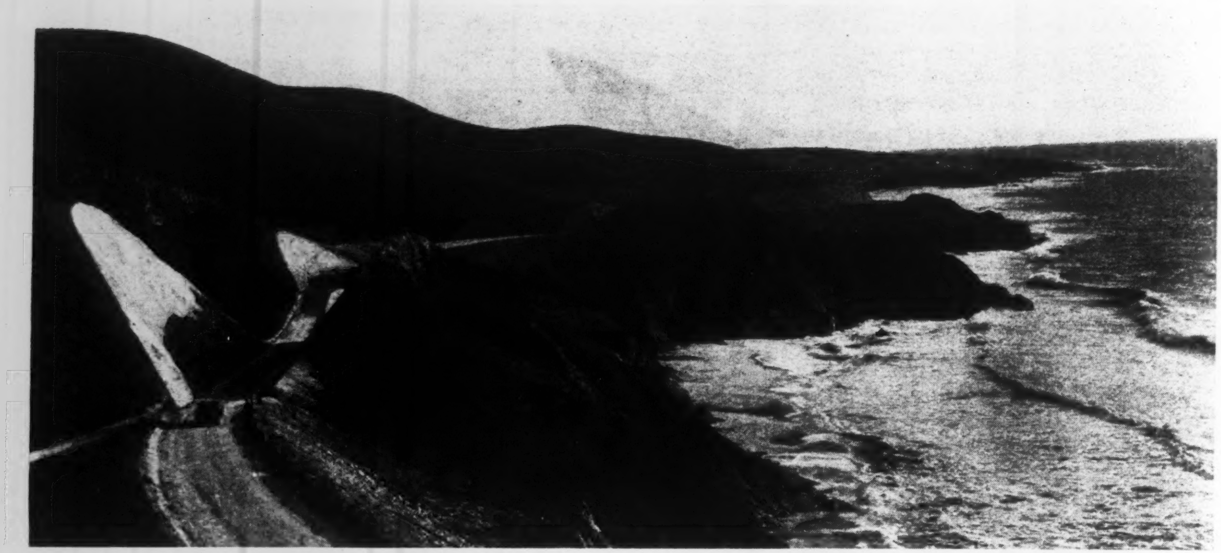

FIG. 1. SCENIC ROAD THAT FOLLOWS THE COASTLINE FOR 93 MI. IN MONTEREY AND SAN LUIS OBISPO COUNTIES

Road Design Stepped Higher

C. H. Purcell
State Highway Engineer, Sacramento, Calif.

Radical revision of standards made by state engineers to increase the safety of higher-speed travel on California highways

California was one of the pioneers in building rigid road surfaces. Every oldtimer will recall its ambitious program of 4-in. concrete paving. Never mind what happened; the next step in pavement thinking left these egg-shell surfaces far behind and since then the steps have been upward in line, profile, pavement width and quality of structure. Now within a year all design standards have been lifted to new and higher planes of transport service. This change is what the following article has to tell. —Editor

California highway development with the present year enters a new period of engineering planning and design. Perhaps it is more accurate to say that the beginning of the new era was in 1937 and that the present year is witnessing its broadening development. But not to quibble over dates there is now being put into highway construction a new concept of engineering purposes in road transport. California highway development has made many such steps in past years; its roadbuilders lifted travelers out of the mud onto thin concrete pavements; the main, 15-ft.-wide pavements have been thickened and widened to 20 ft.; all have been steps upward to keep level with mounting traffic demands and the present change is merely another step, but a higher one. Indeed it is believed that the California Division of Highways has made within the past six months one of the most important changes in design policy yet adopted.

Increase in the last several years of the speed of the average car and of the width and number of fast moving trucks and buses has made it apparent that the 10-ft. traffic lanes, which have been standard in California for many years, are insufficient for safe passing. It is now proposed that a standard 11-ft. lane shall be used on all new construction, making two-lane pavements 22 ft. wide and three-lane pavements 33 ft. wide. In the construction of four-lane pavements the new standards provide that opposing traffic will be divided by a center parting strip between the two inside lanes and that the inside lanes shall be 12 ft. wide and the outside lanes 11 ft. wide.

Similarly on bridges the width between curbs and structures will be increased; where, now a bridge on a road with 20-ft. surfacing is 24 ft. between curbs, under the new policy, with 22 ft. of pavement or surfacing, the bridge deck will be 26 ft. between curbs. Shorter-span structures of 50 ft. or less will be built the full width of the roadbed.

Construction practice for divided trafficways on four-lane highways provides for curbed parting strips of various widths with 4 ft. as the minimum width. The curbs placed along the parting strips are 6 in. high with a moderate sloping face on the pavement side, the batter of this face usually being 4 in. in the 6 in. of height. Several divided roadways with curbed parting strip are now under construction on which a reflecting type of curb is being built; facets or indentations reflect the light from the headlights of the car and increase the visibility of the curb.

Installations of both paved and planted dividing strips have been made. Where conditions permit construction of parting strips 20 ft. or more in width, the policy is to omit the curb, replacing it with a treated or surfaced rock shoulder from 2 to 3 ft. wide.

While the increased cost of the wider construction will reduce the mileage of possible construction, the benefits to traffic of the resulting greater safety will offset this reduction.

Sounder foundations

The wider road increases the necessity for a sounder foundation. Insecure foundation conditions are largely the result of subsurface saturation. Satisfactory drainage in locations which cannot be avoided in the highway line presents a problem which must be solved if distortion or even loss of the superimposed roadway is to be prevented.

More extended and careful investigation of soil and subsoil conditions are to be made on highway projects than in the past. These investigations are a part of the preliminary engineering work and lead to inclusion of proper soil treatment in the design to insure stable roadbed. In spite of apparent greater initial cost, economy has been achieved because loss of sections of road not only involve greater expense for later restoration but also mean interruption of traffic service.

Methods in general use by highway engineers are followed in California involving dewatering by gravity flow in subsurface drains; removal and replacement of unstable material; building an embankment strut between the unstable mass, and adjacent stable material, and construction of a stable roadbed by systematic overloading to obtain displacement of underlying material. It has become the practice to supplement the first two of these methods by excavating trenches to solid foundation under or across the proposed fill or on the lower side of the unstable area and backfilling them with as coarse rock fragments as are available. This type of submerged drain or gravity rock toe wall has proved effective under a variety of conditions.

An experimental method which appears to have considerable merit in dewatering marshy or saturated land, consists of sinking large-diameter wells to the bottom of the unstable material and filling the hole with a porous and granular aggregate. These fairly closely-spaced wells are connected at the original ground surface with a system of transverse and longitudinal rock-filled ditches to collect and lead off the surplus water. It has been found that under the load of the superimposed roadway fill the rate of consolidation of the unstable material is greatly accelerated, and that less time is required between construction of the roadway fill and final paving for achieving settlement and stable foundation than by the usual method of overloading. Care must be taken in construction to prevent lateral movement of the underlying material.

Stabilization of subgrades is generally accomplished with a blanket course of suitable material of sufficient depth and bearing value to distribute the load within limits well under the maximum bearing power of the underlying materials. Where suitable material is not available consideration is given to the use of admixtures, to the native soil to produce greater stability. Experiments have also been made in stabilization of subgrade material with emulsified asphalt and portland cement.

Traffic control and safety

With wider and more stable roads a more positive attempt is being made to apply structural means for controlling traffic. Safety features for traffic control which are receiving attention include extension to all surfaced highways of the practice of placing a double stripe on the center of the pavement the crossing of which into opposing lanes is prohibited. This means of control is used especially where sight distance is restricted on two and three-lane roads. On heavier traffic highways of less than four lanes where adequate sight distance over summit vertical curves cannot be economically achieved, four lanes of pavement are constructed for a sufficient distance to permit safe transition to the normal, narrower width.

Construction of traffic islands for segregation of traffic into proper lanes is receiving much detailed study. Such installations are to provide control at highway intersections where the construction of grade separations is not at present justified or practicable. Judicious placing of

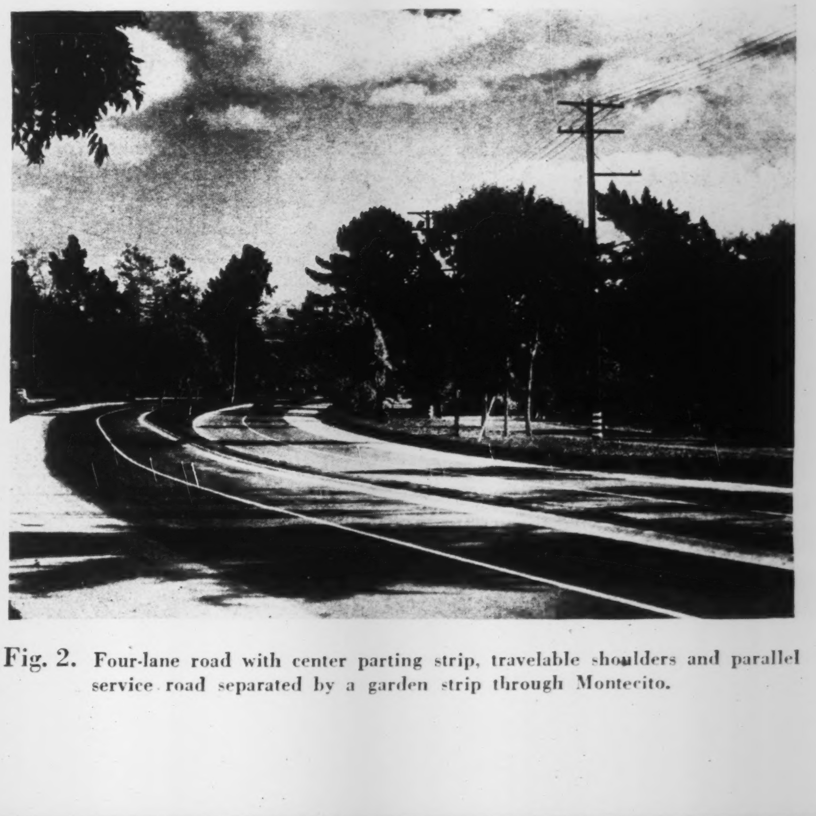

Fig. 2. **Four-lane road with center parting strip, travelable shoulders and parallel service road separated by a garden strip through Montecito.**

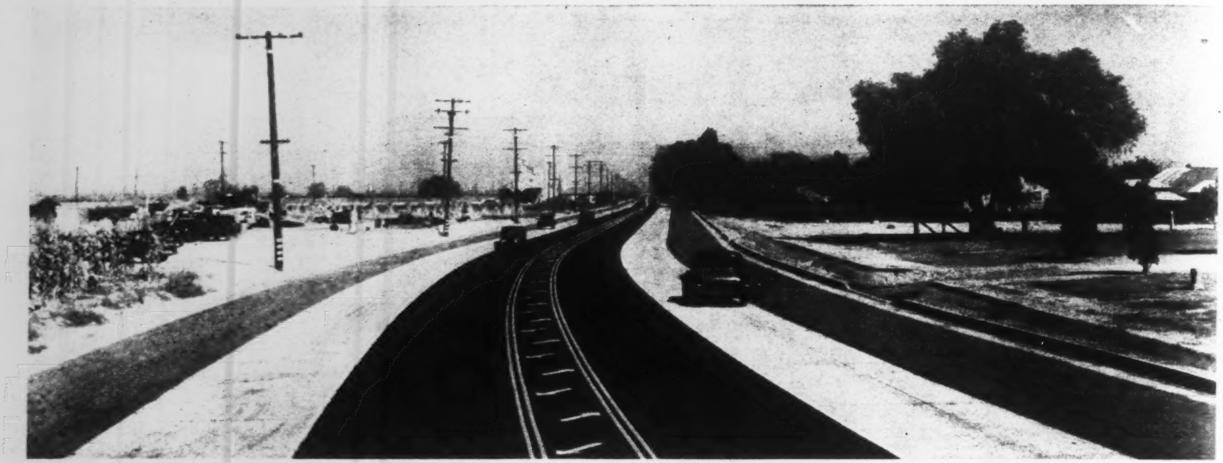

Fig. 4. Alternating lanes of concrete and bituminous mix as on this six-lane road are common; the striped parting strip is roughened by raised arrows.

flared curbed islands at the approach of such intersections segregates from the lines of traffic those cars about to make right turns, and similar islands dividing opposing traffic serve as protection to through traffic and to such drivers as wish to make left turns. For traffic about to make left turns, a short protected lane for slowing down is provided on the inside of the trafficway.

On divided highways or where traffic is unusually heavy the intersection is given further additional width with island protection to provide sufficient space for cross-traffic to stop between opposing ways and make the crossing in two jumps. Features of vital importance to the proper construction of such intersections are adequate signing and lighting. On recent construction of intersections on the state system provisions for signing and lighting have been made and the result of these experimental installations is being studied in an effort to determine the most satisfactory methods.

For control of opposing traffic on heavily-traveled arterials, considerable experimentation has been done with the construction of the parting strip dividing the trafficways. Accident records in California indicate that 20 to 25 per cent of all accidents involve machines traveling in opposing directions and it is felt that the additional expense of divided roadways on four-lane arterials is justified if this type of accident may be materially reduced.

Apparent success of the use of sodium-vapor lights on the San Francisco-Oakland Bay Bridge and its approaches has led to the selection by the Division of Highways of two sections of state highway for experimental lighting. One of these will be about 3.5 mi. long between San Francisco and South San Francisco on the Bay Shore Highway in San Mateo County and the other will be 1.5 mi. from the north bridge head on the Waldo Approach of the Golden Gate Bridge in Marin County.

In 1930 the state prepared a comprehensive ten-year program for development of the state highway system, but with the addition of 6,800 mi. of county roads to the state system by the 1933 legislature, extensive readjustment in the program became necessary. To make these adjustments properly, a transportation survey of the entire state was made in 1934 in cooperation with the federal government.

The scope of the present planning work in California consists of surveys of selected roads involving studies of alignment for rates and length of grade, curvature and superelevation and both horizontal and vertical sight distance. Surfacing is being studied for type, width and condition, and data are being accumulated on general and detailed physical and topographical features. This survey will include investigation of about 9,130 mi. of state highways, federal aid highways, national-park and national-forest highways and county roads.

While these several general studies which have been made in California have proven of inestimable value in planning improvements and shaping policy for highway development, the semi-annual traffic studies which are conducted in January and July, amplified by monthly counts at selected stations, are still considered vital in determining traffic trends.

The big problem is financing. Finances for state highway construction and maintenance in California remained unchanged during 1937, the 3-c. state gasoline tax being divided in the ratio of 1c. to counties, ¼c. to incorporated cities for improvement to city streets other than state highway routes, ¼c. for use on state routes within cities, and 1½c. to the Division of Highways for use on the state system. The net revenue of motor vehicle fees ($3 per year on passenger cars; sliding scale for trucks) is divided equally between the Division of Highways and the counties. While the total state revenue accruing for state highway work during the fiscal year 1936-1937 amounted to about $33,000,000 it was insufficient even when supplemented with the $16,500,000 in federal aid earned during the period, to meet the needs of maintenance and construction on the 14,000 mi. of state highways.

Equitable distribution of the limited funds to a well balanced program becomes increasingly difficult with demands of a rapidly growing volume of high speed traffic for superhighways on a few arterials. The resulting comparatively large expenditure on a relative small mileage has materially complicated the administration of highway finances.

Expansion Joints in Concrete Tanks

by Henry D. Dewell
Consulting Structural Engineer, San Francisco

Satisfactory five-year operating record of refillable, floating-plate type joints in water pretreatment plant

A service record of almost five years bears evidence of the effectiveness of an expansion joint design developed for the concrete walls and floors of tanks and conduits built in the 1932-33 addition to the water pretreatment plant at Sacramento, Calif. Review of the details of the expansion joints in similar structures elsewhere (both of the conventional crimped copper sheet type and special designs) and investigation of their service records indicated that all of those reviewed had given some trouble either in construction or in service. In designing a type of joint for the Sacramento plant the attempt was made to overcome deficiencies of the more conventional joint heretofore used. The design took into account the probability that the several tanks would be emptied frequently for cleaning and thus the joints would be subjected at different times to air temperatures varying from 18 deg. F. to 115 deg. F. Laboratory tests preceding adoption of the design used were made to include this entire temperature range under hydrostatic pressures twice the maximum under operating conditions. A general description of the 1932-33 addition to the Sacramento plant was published in *Engineering News-Record* July 6, 1933, p. 1.

The joint adopted consists essentially of a 1-in. separation of the abutting edges of two concrete slabs with the separation bridged by a flat copper plate embedded in the concrete of one slab and floated in soft mastic packed in a recess formed in the concrete of the abutting slab. A total of about 300 lin. ft. of vertical and horizontal, straight and curved joints of this type was used in concrete wall, floor and roof slabs 10 to 12 in. thick. Throughout almost five years of service, including two winters of exceptional and protracted cold, the joints have definitely contracted and expanded without any observable leakage and the concrete structures are almost without cracks.

Construction of the joint

In the construction of the joint, the 24-gage black-iron sheet which forms the recess in one of the abutting concrete slabs was bent in the shop into the cross-sectional shape shown at *A* in Fig. 1. The flat copper plate of 12-in. width was next inserted for about half its width in this metal form and packed with the special mastic filler in an unheated condition. The sheet metal form containing mastic and plate was later cast in the edge of one of two abutting concrete slabs, leaving form containing mastic and plate a $6\frac{1}{2}$ in. width of copper plate projecting for subsequent embedment in the concrete slab yet to be poured.

The inner or lower half of the joint in the concrete slab, *i.e.*, on the side of the copper plate away from the water face, was filled with two layers (*B*) of $\frac{1}{2}$-in. preformed asbestos and rubber joint-filler which serves as an elastic construction-separation of the concrete, furnishes support to the copper plate and also serves as backing to prevent the more elastic, semi-liquid mastic from being forced out through the joint.

Tests of joint

When the joint was designed final decision on the exact specifications for the filler had not been reached. With the thought that the material selected might deteriorate or need replenishment during service, provision was made for refilling by tapping the sheet metal form with $\frac{1}{2}$-in. pipes about $2\frac{1}{2}$ ft. on centers. These pipes were led out to the water face of the concrete slab and were fitted with nipples to be kept closed except when replenishing the filler by means of a grease gun.

To eliminate the element of chance in selecting the filler material and to make sure that the design of joint was practicable and efficient for the expected temperature variations and water pressures, arrangements were made with the Abbot A. Hanks, Inc. testing laboratory in San Francisco for a series of tests on filler materials thought worthy of consideration, the investigation to include tests upon full size, laboratory-constructed, short sections of typical joint.

Two kinds of tests were made. In the first an expansion joint was set in a section of concrete corresponding to the arrangement shown in Fig. 1, using a slab thickness of 10 in. A 6-in. length of such a joint was so arranged that the joint could be opened and closed in a manner simulating the movements expected to result from temperature changes sufficient to cause expansion and contraction in the concrete structure.

The second test form was made with only the sheet metal form of the expansion joint and without any concrete. The purpose was to ascertain the strength of the bond between the copper plate and the joint filler; hence the essential feature of this test was pulling the free end of the copper plate to measure the hold upon it exerted by the filler material in the metal chamber. Tests of both kinds were made under a set-up such that water pressure could be applied to the inner surface of the joint and the effect of this pressure

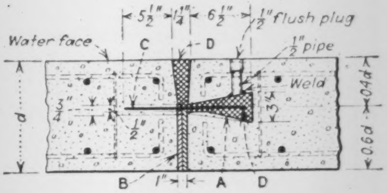

Fig. 1. Section through floor slab showing simplest form of contraction joint design. Modifications of this design were used for vertical walls and around large pipes entering the tanks below water line.
A: 24-gage sheet-steel form packed with mastic. B: 2 layers of preformed asbestos and rubber expansion joint filler below copper plate. C: 26 to 32-oz. copper plate $12\frac{1}{4}$ in. wide. D: Heavy body expansion joint mastic.

on the filler observed. The tests were made at 30, 70 and 130 deg. F.

Marine glue (of which two consistencies were tried) was tested after the glue had been heated and placed at 240 deg. F. On cooling to 70 deg. F. there was appreciable shrinkage and some cracks in the filler between the concrete face and around the ends of the copper strip. The joint then was subjected to a temperature of about 28 deg. F. for 5 hours and at this temperature the joint was moved 1/16th in. in the direction corresponding to shrinkage movement of the concrete. Marine glue was rejected because of its shrinkage on cooling, apparent brittleness, lack of bond to metal, and lack of ductility. No primer was used.

Asphalt fillers of five different grades were then tested without use of primer. All of these were set up while hot in the second test form, subjected to 28 deg. F. temperature for 5 hours and tested with the load pulling on the free end of the copper strip. The first 3 samples were rejected because the (a) asphalt mass fractured and (b) ductility and bond to the metal were negligible. Samples 4 and 5 also were unsatisfactory, one because of brittleness at 28 deg. F. and the other because of brittleness and too low a melting point.

Emulsified asphalt of two different grades was tried, one a liquid and the other a semi-solid. After having set for 48 hr. the usual 28 deg. F. temperature was imposed for 5 hr. and then the load test was made. This material, at the low temperature, had some elastic properties but was considered unsatisfactory because of lack of bond to the metal. Again, no primer was used.

A special biturine mastic expansion joint filler manufactured by the General Paint Corporation and furnished in two consistencies, light body and heavy body, respectively, was then tested. This mastic is a putty-like substance made from refined coal tar pitch, natural rock asphalt, long fiber asbestos and nondrying coils. It is insoluble in water, fuel oil (of 20 gravity), alkalies and most commercial strength acids. The light body mastic was found to be too thin but with the heavy body mastic, very satisfactory results were obtained and a complete series of tests was run.

Before packing the sheet metal forms with this mastic, form surfaces were painted with a special primer. With temperatures ranging from 28 deg. F. to 130 deg. F., and a movement of the joint of ½ in., this filler material was used in the first test form under pressures continuing over 7½ hr. and reaching a maximum of 30 lb. per sq. in. This latter pressure was continued for a period of 1 hr. after which the only indication of pressure on the flow or movement of the filler in the joint was the appearance of a small bead of the primer material on the exposed edge of copper plate.

This heavy body expansion joint filler was therefore adopted, was used in all joints on the job and has given satisfactory service for nearly five years without any maintenance whatever.

Particular mention should be made of the slope change on the lower face of the sheet metal form (Fig. 1) as contrasted with the uniform slope of the upper face of the form. The shape of this lower face, which gives a clearance of only about ⅛ in. with the floating copper plate, was found by test to be important in providing resistance against the flow of mastic filler in the normal direction of pressure through the filler around the embedded end of the copper plate. In the first sheet metal form tested the upper and lower faces were both straight slopes, giving a ⅜-in. opening above and below the copper plate. This clearance below the plate was found to allow some flow of mastic which was entirely stopped by decreasing this dimension to ⅛ in. as shown in Fig. 1.

The design and construction of the addition to the pretreatment works was under the direction of James S. Dean, city manager of Sacramento. Other officials were Fred J. Klaus, city engineer, R. E. Mittelstaedt and Carl M. Hoskinson, superintendent and chief engineer, respectively, of the division of water. Harry N. Jenks was consulting sanitary engineer and the writer was consulting structural engineer.

The Madeira-Mamore Railway; Brazil

ACQUISITION of the Madeira-Mamore Railway by the Government of Brazil closes the last chapter of the history of this spectacular enterprise as a private line. The event calls to mind the romantic enterprise of the construction of this 250-mile railway in the jungles of the heart of Brazil by American engineers. Its purpose was to bypass a series of rapids on the Amazon River and connect two of its navigable tributaries, thus extending transportation for several hundred miles up these rivers. The first survey of the line was made by a party of American engineers as far back as 1878, but work was abandoned after a few miles had been actually built and operated. In 1907 another American engineering expedition took up the exploration and surveys, and the line was completed about 1912.

In 1931, the Brazilian Government assumed control of the railway, and since that time there has been continual controversy and litigation between the government and the company, each claiming that the other had not carried out certain items of its part of the concession and contract. Under the new and final agreement of 1937, the 1909 contract between the two parties is rescinded. The government will pay an indemnity to the company, and the company will recognize the government as sole proprietor of the railway and all its property.

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California Statute Designed For Earthquake Resistance

A statute soon to be unveiled at Forest Lawn Memorial Park Glendale, Calif., has been designed to resist earthquake loads, after extenive model studies. The 62-ton statute, a copy of Michaelangelo's David, has a cross section of only a few inches at the ankles, and the major part of the mass is concentrated in the chest and shoulders, 18 ft. above the base.

On the basis of shaking table studies by Professor Martel of California Institute of Technology, a concrete block with a mass about 50 per cent greater than the statute was used as a base. The statute itself is mounted on a set of four stainless steel plates, scored and filled with graphite. The plates will allow several inches of movement horizontally in case of a severe earthquake.

Some California Engineering

Comments on work and practices transcribed from an editor's travel notes

Los Angeles

It will be a long time before the traveler coming into Los Angeles from north, south or east will fail to see evidence of the destruction caused by the March flood. Herculean efforts at repair got the highways and railways open and removed mud and debris, but permanent rebuilding will take some time—and more money than is immediately available.

From a trip over most of the damaged area it is evident that no particular type of bridge exhibited any marked superiority in meeting the floods, concrete, timber and steel structures being indiscriminately wrecked. Foundation scour was probably the principal cause of a majority of the collapses. Conversely, many bridges were saved when the approach fills washed out, reducing the head on the bridge and the velocity of the flow beneath it.

Floods produce freakish results, and when accompanied by mud, rocks and debris they create some novel situations, for example, the necessity for a detour around a modern railroad underpass filled nearly to the top with mud. Some 10,000 cu.yd. of it must be removed from such an underpass east of Riverside before it is again available to traffic.

In Long Beach at the mouth of the Los Angeles River a wide gap in a timber trestle bridge is a reminder of the seven persons who were swept out to sea and drowned when this section of the bridge collapsed. Why sightseers were allowed in such an obviously dangerous location is not easy to understand. It suggests to authorities the necessity for policing of such danger spots.

All floods, however, have their brighter side, principally because the necessary rebuilding is invariably superior to the structures that were destroyed. A case in point is the wrecked Southern Pacific Railroad bridge that crosses the Los Angeles River near Figueroa St. in Los Angeles (Fig. 1.) Here three spans with two piers in the streambed will be replaced by a single span, giving a clear floodway and assurance of safety for the railroad.

Traffic solutions sought

No city in the country, unless it is Detroit, has a traffic problem comparable to that of Los Angeles. At least 80 per cent of the daily transportation requirements of the area is supplied by the private automobile, so that, despite miles of wide boulevards and acres of downtown parking lots, traffic congestion is intense. Elevated highways are being actively discussed, and in the meantime construction of the first grade-separated traffic artery is getting under way. This is the Arroyo Seco Parkway, extending the present north outlet, through the Figueroa St. tunnels and over the new Los Angeles River bridge, 9 miles north to Pasadena.

Novel recommendations for an elevated highway have been made by the Automobile Club of Southern California as a result of an intensive traffic survey made by its engineering department. The recommendations involve a network of grade-separated "motorways," of parkway type in residential districts and of an elevated-highway type in the business districts. The recommended design of the latter includes a series of "motorway buildings" connected by bridges and located in a 100-ft. right-of-way through or near the center of the block. The first and second floors of these buildings would be devoted to retail business, the third floor to the motorway, the next few upper floors to parking facilities and the remaining floors to office space. The expense would be tremendous—$2,000,000 a mile outside of the business districts and $4.50 per sq.ft. of floor area for the motorway buildings including the connecting bridges. However, since 40 per cent of the motor vehicles in California are registered in Los Angeles County it is obvious that only an expensive solution will suffice to meet the problem.

Buildings against earthquakes

Building activity in Los Angeles is not so apparent as in the recent period of school reconstruction, but those buildings which are under way reflect earthquake design quite plainly. The steel framework of the new Federal Building, for example, appears to be of normal design, yet it is being encased in heavily-reinforced concrete. The Union Station, nearby, has built-up columns of latticed type in its concourse but these structural steel members are merely a part of the reinforcing of concrete columns that will contain rods as well. Out in Hollywood, the Columbia Broadcasting Co. has finished an

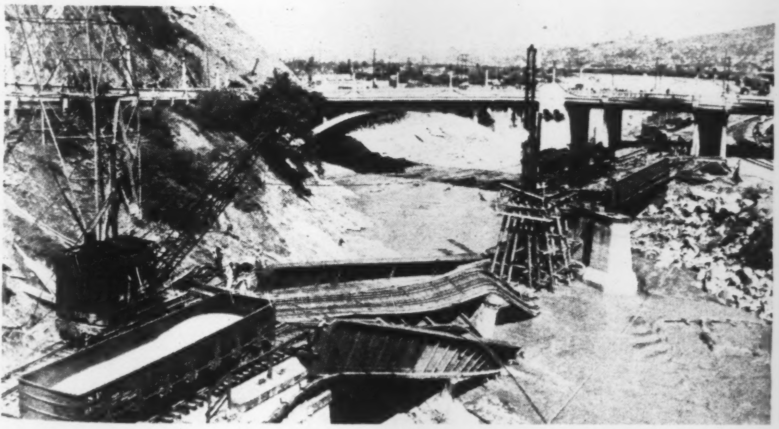

Fig. 1. **Reconstruction will substitute a single span for these three flood-wrecked spans of the S.P.R.R. bridge in Los Angeles**

interesting building in which several different types and heights of structure are involved; each of these elements, including its foundation, is separated by an open joint from the others so that it may vibrate at its own frequency undisturbed by the others.

Incidentally, this broadcasting building incorporates the most modern theories of buildings designed for this relatively new industry. One of its most obvious features is the use of walls in the studios that slope inward from floor to ceiling. Such design improves acoustics but it is rather weird and disconcerting when seen for the first time.

One thing that earthquake design requirements have fostered is the increased use of light-weight concrete in repair and modernization work. The law requires that the dead weight of existing buildings, not designed for earthquakes, shall not be increased. Thus only by removing heavy materials and substituting lighter ones can floor areas or building heights be added to.

Water from across the desert

No visit to Los Angeles is complete without an inspection of the Colorado River aqueduct, and a hurried two-day trip over the 240-mile line from the Cajalco Reservoir in the suburbs to Parker Dam on the Colorado River reveals what a tremendous and varied project it is.

There have been wet tunnels before but none to compare with San Jacinto. At the current heading, reached from Potrero shaft, water is pouring out of the roof in a single stream that requires pumping at a 15.000 gal. per min. rate. The noise of falling water is all that can be heard although 25 ft. ahead the drills are working steadily—incidentally, on a dry face, but with no assurance that the next shot will not bring down a fresh deluge. When this tunnel is holed through, the aqueduct will be finished, and one of the most difficult tunneling jobs in history will have been successfully completed.

At Parker Dam, which goes down 237 ft. under the Colorado River bed and rises only 80 ft. above it, work is approaching completion, with riveting of the 50x50-ft. crest gates and pouring of the concrete piers to support the gate lift machinery. (Fig. 2). Preparations are under way to close off the diversion tunnels so that water storage can be begun soon. Sensing the end of the job there is already speculation as to where the huge construction cableway will go next. It is the same one that built Boulder Dam and it is far from worn out.

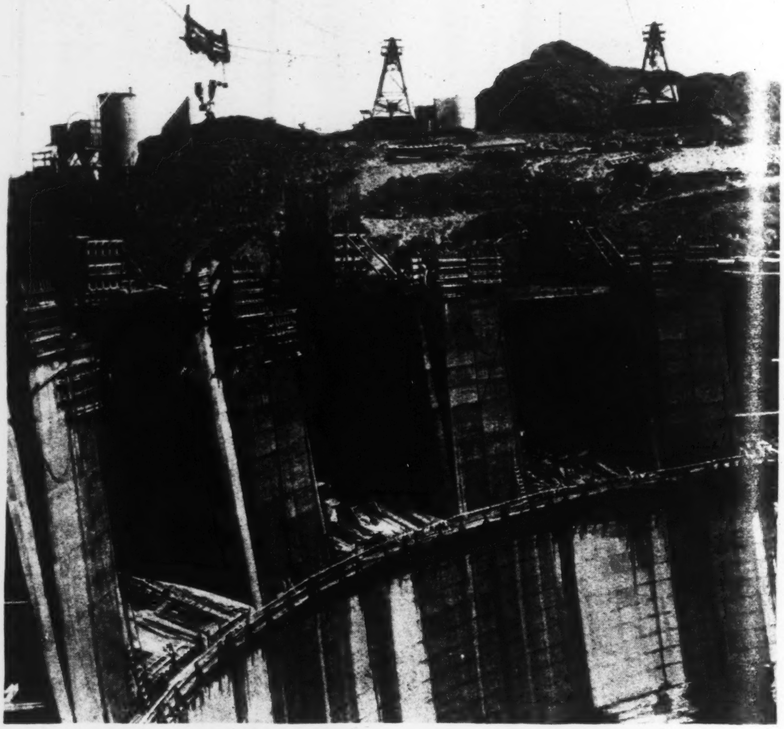

Fig. 2. Topping out Parker Dam with concrete in the piers that will support the gate lifting machinery.

In the mountains just west of Parker Dam, work is under way on the two reservoirs that take water from the first two pump lifts on the aqueduct. Gene Wash Dam, a small concrete arch that forms the first reservoir, is finished except for the operations incident to cooling and curing the concrete. These require a refrigerating plant, cooling tower and pumps, an assemblage of equipment unheard of ten years ago and particularly impressive here because the site is completely deserted, the cooling plant operating automatically.

Driving through Copper Basin reservoir, whose topography suggests those bizarre pictures of the mountains of the moon, one enters a deep narrow canyon and, rounding a projecting cliff, is confronted by as picturesque a dam building operation as can be imagined. Copper Basin Dam is just a narrow plug (32 ft. thick at the base) between the canyon walls but it rises to a height of 250 ft. blotting out all but a patch of sky directly overhead. A cableway hung from the cliffs 500 ft. above lifts the concrete into the forms. The dam is notable for its unique foundation and abutments of railroad rails which are encased in the dam in an attempt to reduce cracking of the concrete at the edges.

Pumping plant construction at the five lifts along the aqueduct line is in various stages. Those plants that are approaching completion present a colorful picture, with white concrete walls, red tile roofs and the aluminum-painted discharge pipes that climb the mountains in the background. W.G.B.

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Milwaukee Waste Disposal

THE MILWAUKEE street department through C. O. Davis, superintendent of street sanitation, reports a 1937 per capita cost of $1.68 for street and alley cleaning and ash and rubbish removal. Some 660.000 cu. yd. of ashes and rubbish and 53.500 cu. yd. of street dirt was removed.

A.W.W.A. Meets in New Orleans

Technical sessions at the American Water Works Association Convention stress air-conditioning requirements, corrosion control and management practice.

WITH A PROGRAM so widely diversified as to touch upon almost every phase of waterworks service from accounting procedures to purification and public relations problems the American Water Works Association held its 58th annual convention in New Orleans, April 24-28. The registration, membering about 1,150, was the largest since the 1929 meeting at Toronto. Seventy-four manufacturers crowded into the exhibit hall to completely fill the 100 booths that were available.

Reeves J. Newsom, consulting engineer of New York was elected president to succeed Eugene F. Dugger, general manager of the Newport News, Va., Waterworks Commission, and William W. Brush, editor of *Water Works Engineering*, was elected treasurer.

At the business session of the meeting approval was voted for the establishment of two new grades of membership—juniors and affiliates—and for the creation of the post of vice-president. Approval was also given to the recommendation that section directors hereafter reside in the section territory that they represent. The entire membership will be canvassed by letter ballot for a final vote on these matters.

Technical sessions

Interest in the technical sessions, at which more than 100 papers were read, centered chiefly in discussions on air-conditioning demands, water department experiences with sewer rentals and corrosion control. Highlighting the meeting of the finance and accounting division was the submission of the final draft of a complete waterworks accounting manual. Among other matters on which attention was focused were questions concerning association action toward personnel problems, and revision of meter specifications. Activities in water supply practice across the Mexican border were described in two papers on recent advances in purification and distribution at Vera Cruz and Mexico City.

The following summary of the technical papers has been segregated for convenience to the reader into classifications corresponding to that phase of waterworks activity to which they refer. These include: plant operation, supply and service, purification and quality, management and accounting.

Plant Operation

IMPORTANT ELEMENTS of the New Orleans waterworks, which converts the muddy Mississippi River supply into sparkling clear water, were described by A. F. Theard, general superintendent of the sewerage and water board and George C. Earl, consulting engineer, New Orleans. The water is first passed through grit chambers and then mixed with lime and iron sulphate. After passing through mile-long mixing channels, the water is settled and then filtered. Following ammonia and chlorine treatment it is either pumped directly into the mains or stored in clearwater reservoirs until needed. The plant capacity is 112 million gallons per day (*ENR* April 21, 1938, p. 596).

Urging revision of A.W.W.A. meter specifications, written some sixteen years ago, a panel discussion by Clem. A. Gallagher, superintendent of services, Louisville, F. W. E. Weisse, Corpus Christi, G. L. Fugate, chief engineer, Houston water department and A. P. Kuranz, superintendent of water, Waukesha, Wis., revealed that they should be "made more definite, complete and exclusive."

Mr. Gallagher stated that dissatisfaction and cut-throat competition in the meter field were traceable to the laxity of present specifications, which made it possible to produce meters of identical size ranging in price from $4.50 to $12.00. Manufacturers' standards were said to be far more rigid than association specifications.

Standardization of reading dials on meters was suggested by Mr. Weisse. Because of lack of uniformity it was said that in Corpus Christi more work was required in reading the 26,000 water meters than in going over 93,000 electric meters. A closer standard on registration accuracy at low flows was recommended by Mr. Kuranz who cited cases of meter under registration, one of which showed as much as 44 per cent error.

Merits of prime movers

In summarizing a discussion on the reliability merits of electric, diesel and steam power for waterworks operation, W. W. Hurlburt, engineer of waterworks, Los Angeles, stated that a great deal depends on individual circumstances. Where electricity is used with dual sources of supply it is unlikely that both would fail at the same time, and therefore this type of power has as much reliability as steam. Regarding diesel and steam power, both types may be subject to failure and duplicate or standby service is necessary. The question then, he said, is not one of reliability so much as expense in providing service which provides duplicate facilities.

Electric power is not as reliable as steam, said W. V. Weir, superintendent of the St. Louis County Water Co., because outages will occur. It is necessary, therefore, to provide elevated storage facilities to insure reliable service. R. H. McDonnell, consulting engineer, Kansas City, Mo., said that the diesel engine has shown remarkable reliability for water service particularly in view of the fact that it is a relatively new type of prime mover. He cited records of performance in 26 plants where a total of 61 engines were used, which indicated that there was only 1/5 of 1 per cent hours of outages.

Corrosion control

Cement linings and tar coatings were credited with having greatly increased the economic life of pipe by Thomas H. Wiggin, consulting engineer, New York, who reported his observations on interior corrosion of distribution mains. It is generally believed, said Mr. Wiggin, that only soft waters are corrosive, but this is not the case because many types of water have been found to cause corrosion troubles. Mr. Wiggin conclude that too little use is being made of protective coatings to sustain high coefficients of flow.

Corrosion may take place without observing the tell tale of "red water", said George Norcom, consulting sanitary engineer of the Federal Water Service, New York, who described water conditioning for corrosion control. The addition of an alkali to produce a film or coating on the interior of tuberculating pipe was described in connection with treatment of Lake Erie water, a water generally considered passive. The distribution system showed that this water had caused a great loss of capacity due to tuberculation, and pipe cleaning was necessary. At the same time treatment of the water with lime was started to raise the pH to 7.9 (the value was critical because beyond pH 8.0 softening took place and the lime was precipitated). Chemical balance is maintained by this treatment and a scale is being formed in the pipe which, thus far, has slowed down the corrosion rate.

The use of limestone-contact beds for control of corrosion in waters having an excess of carbon dioxide or deficiency in hardness was described by I. M. Glace, consulting engineer, Harrisburg, Pa. He recommended this procedure as particularly well adapted to small plants because of its simplicity and low cost. The addition of ground limestone was more expensive than lime treatment for corrosion control, in the Hetch Hetchy water of the San Francisco supply according to G. E. Arnold, water purification engineer.

Fig. 1. President Dugger listens attentively to S. F. Newkirk's talk on service pipe.

Fig. 2. On the crosswalk of the coagulation basins at the New Orleans water plant.

Other experiences with corrosivity treatments were described by D. E. Davis, consulting engineer, Pittsburgh, (zeolites), S. T. Powell, consulting engineer, Baltimore (deaeration); J. W. Ackerman, chief engineer of the Utica, N. Y., Consolidated Water Co. (chloramination) and Earl Alexander, waterworks superintendent, Rome, Ga., (silicates and lime).

Soil corrosion

In a paper on soil corrosion studies and pipe protection methods, F. N. Speller and V. V. Kendall, both of the department of metallurgy and research, National Tube Co., Pittsburgh, reported that this type of corrosion is electrical in nature and that all metals are subject to it in certain types of soil. Worldwide interest and resulting developments have now provided improved means to combat pipe deterioration through informative survey procedures, better methods of applying outside coatings and increased use of cathodic protection.

The principles of corrosion prevention by cathodic protection were outlined by Starr Thayer, consulting engineer, Houston, who first applied the method in 1931. Corrosion, which may be caused either by electrolysis, long line currents, or soil action, is the result of currents in the pipe flowing through the wall of the pipe where they discharge into the soil; as they leave the pipe these currents take metal with them. Although the current may be small it can do much damage, illustrated by the fact that one ampere leaving the pipe wall will take about 20 lb. of metal within a year.

Protection can be obtained by causing a current to flow from the soil to the pipe of sufficient strength to offset the destructive current. In order to do this, it is necessary to have a source of direct current of low voltage and high amperage. The positive terminal of a generator is then connected to a mass of junk iron buried in soil near the pipe and the negative terminal is connected to the pipe. As current is forced from the scrap metal it passes through the soil onto the pipe, and is then returned through the pipe wall. The cost for applying these protective devices to a pipe line already in service varies considerably, but in general it was said to amount to 5 to 10 per cent of the cost of renewing the line.

Service pipe

No one material is suitable for all localities, all types of water and all kinds of soil, so therefore there is no "standard" service pipe, said S. F. Newkirk, engineer of the board of water commissioners, Elizabeth, N. J. Looking at the matter from a health standpoint he said that salts of most pipe metals are irritant poisons, but the amount taken into solution by many waters is negligible. The character of the water was held to be the one of the determining factors in making a selection of service pipe, and lead was cited as a material which should not be used to convey water charged with carbon dioxide. W. A. Pierce, manager of the Racine, Wis., water department, pointed out that stray electric currents may change the character of water served through certain types of pipe.

The present permissible limits of zinc (5 p.p.m.) and copper (0.2 p.p.m.) in water could be raised without creating a health hazard, according to Robert Spurr Weston, consulting engineer, Boston. Disagreeable tastes will be produced and make water unpalatable before the health hazard stage is reached, he said.

Water Supply and Service

From a study of water consumption in 434 of the 486 cities with a population over 20,000, O. C. Holleran, chief of the industrial marketing unit of the Department of Commerce, reported that there has been a reasonably constant increase in demand in practically every city, with the increases ranging from 1 to 50 per cent. Mr. Holleran further stated, "The danger of overdemand from air-conditioning equipment which appeared so serious a year ago has been markedly reduced in seriousness during the past season." His conclusions were based on the fact that air-conditioning equipment manufacturers are producing water conserving types of equipment. The revival of industrial operations was held to be a large factor in increased water consumption.

The most startling revelation from the survey, said Mr. Holleran, was the apparent lack of knowledge of actual conditions within operating zones shown by responsible authorities in many communities. In many instances air-conditioning equipment was held accountable for increased water use but in a number of cases these conclusions were drawn without any information on the number of air-conditioning units installed or the amount of water they used. Data from some cities give an indication of possible requirements for air conditioning; Baltimore, for instance, reports that 10 per cent of delivery capacity is used for air-conditioning purposes; Brookline, Mass., gave figures indicating 11 to 22 per cent capacity; Petersburg, Va., and Waterbury, Conn., reported 11 and 10 per cent, respectively.

The problem of unbalanced conditions in water systems was said to be of major seriousness. One city reported that it could increase pumpage 350 per cent, but its mains would only handle 5 per cent more. In another place, the mains will carry 1,500 per cent but the pumps will handle only 300 per cent more demand. Other cities stated that they have adequate pumping and distribution facilities but inadequate treatment facilities.

The growth of air conditioning in Chicago was reported by Loran D. Gayton, city engineer, who stated that last year 1,257 units were installed as compared with 187 in 1932 and 887 last year. An increased water demand in 1935-36 of 38 per cent, corresponded with a tonnage increase of 35 per cent in air conditioning; the fact that last year the water demand was only 10 per cent higher than the year before, despite an increase of 26 per cent in air conditioning tonnage, was attributed to a cool summer period and the late installation of many units. More than a quarter of the installations in the city are located in the downtown area, said Mr. Gayton, and theatres as a group lead in total tonnage. Although the city is in a position to supply all the water that is needed, the sewer system is inadequate in capacity to handle the discharge.

In Lincoln, Neb., the rate of increase of air-conditioning equipment is flattening out, and D. L. Erickson, city engineer, believes that no serious problem confronts the water department. Having developed a new source of water in 1932, the city has an ample supply and has encouraged use by offering to air-conditioning installations the lowest rate on the schedule (10c per 1,000 gal.) provided a separate meter was installed. Accurate consumption data has been obtained from 38 installations and this shows that where air conditioning is used water consumption has increased 120 per cent. Records from the largest system in the city (a 250-ton unit) show a maximum demand of 600 gal. per day per ton of refrigeration. Pumping station records reveal that air conditioning causes a one-third increase in pumping rate during the day.

Others taking part in the discussions included L. S. Vance, engineer of the Louisville Water Co.: W. V. Weir, St. Louis County Water Co. and T. L. Amiss, Shreveport, La., water and sewerage department.

Groundwater supplies

Related papers on groundwater supplies—the general situation in the lower Mississippi Valley, well supply problems in Houston, and recent trends in legal control of water resources—were presented by V. T. Stringfield, U. S. Geological Survey, Washington, L. R. Howson, of Alvord, Burdick, and Howson, consulting engineers, Chicago, and David Thompson, U. S. Geological Survey, Washington.

Mr. Stringfield pointed out that the lower Mississippi area was formerly a great bay that had gradually filled with sediments which formed alternate layers of clay, sand, gravel, limestone and marl. These formations are highly productive of water and most of the municipal supplies in this region are derived from them. Although ample water is now available careful observations are constantly being made to determine changes which might indicate overdraft. Among the special devices used in these observations are current meters which determine velocities at different depths in a well, and electrical salinity indicators for measuring chloride concentration.

The problems of Houston, which depends entirely on groundwater were detailed by Mr. Howson. The city had a population increase of 120 per cent during the last decade (1920-30) and is still growing. Because of the heavy drafts being made on the groundwater it was his opinion that it was not economically feasible to depend on this source of supply. Nineteen wells with a capacity of 43 m.g.d. are operated by the city, and in addition, there are more than 400 private wells. The city wells, 12 in. in dia. and averaging 1,500 ft. in depth, have a relatively short life of about 12 years. The cost of installation is $50,000 and yearly maintenance is about $412. Due to the need for frequent replacement of wells and the possibility of salt water contamination from overpumping, it has been recommended that a surface supply be developed.

Urging the necessity for all the states to place some control on groundwater resources before they are destroyed, the paper by David Thompson and A. G. Fiedler traced the development of water rights legislation in this country. Of the existing doctrines—common law or so called English doctrine, correlative rights and appropriation—it is their conclusion that the adoption of the latter is the most satisfactory manner of bringing about the desired control. Necessary legislation for this purpose could be obtained in any state, where there is not now a constitutional limitation, it was said, either by constitutional amendment or by the enactment of a carefully written statute.

Mexican water supplies

Evidencing the advance of water supply practice in Mexico, were two papers describing work at Mexico City and Vera Cruz. At the latter place, largest and most important seaport in the republic, a 6-m.g.d. rapid sand filter and pumping plant was recently placed into operation. New facilities were badly needed, according to D. G. Alarcon, chief engineer of the Junta Federal de Mejoras de Vera Cruz, who stated that until this year the city could supply only 25 gal. per capita per day; and at that it was possible to operate the slow sand filter system only 5 hours a day.

The new filter plant has its own electric generating station operated by diesel engines. Lime and alum is automatically fed to the turbid river water supply which is then given 3-hr. sedimentation. After being filtered through six 1-m.g.d. rapid sand filters designed after American practice, the water is chlorinated. It reaches the city, some 8½ miles distant, through a 24-in. cast iron main. By means of a balancing reservoir near the city pressure in the distribution mains is kept at 40–45 lb. sufficient to carry water above the tallest building in Vera Cruz.

In describing the water supply of Mexico City, Eduardo Molina, director of water and sanitation, Federal District, traced the beginnings of the systems to the year 1465 when the Aztecs built a twin earthen aqueduct from distant springs. The city lies in a basin surrounded by volcanic mountains and there are many springs which, due to the natural filtration provided by volcanic sands, furnish a high quality water.

Fig. 3. Delegates from Mexico; Domingo Alarcon, chief engineer of Vera Cruz and M. M. Merrick, consulting engineer, Mexico City.

Since 1903 the source of supply has been a group of springs which yield 70 m.g.d. of water. This is pumped into a concrete aqueduct leading to covered reservoirs in the city 20 mi. away. For several years it has been impossible to meet consumption demands of 100 gal. per capita per day and as a result it has been necessary to resort to intermittent service during the night. Low pressure is maintained in the pipes during these periods in order to prevent groundwater from gaining access to the mains.

The present improvement program consists of rehabilitating the aqueduct (where 30 per cent of the flow is lost through cracks), construction of a new pumping station, and the installation of piping to tap new sources of supply.

One of the most interesting features of the piping, which is 48-in. cast iron, is the use of rubber-packed couplings at the pipe joints. These couplings are used in lieu of bell and spigot connections because the latter are jarred apart by underground movements during the severe and frequent earthquakes that visit the city.

Pipe studies advancing

A report of tests and studies directed toward the development of a new formula for the design of cast-iron pipe was given by T. F. Wiggin, consulting engineer N. Y., W. J. Schlick, Iowa State College, and M. L. Enger, University of Illinois. These tests, outlined in bulletins from both schools, are concerned with physical behavior of the pipe metal as well as with the resistance of pipe to both external and internal loading.

Reporting for the committee on pipe line coefficients, the chairman, Clinton L. Bogert, consulting engineer, New York, stated that a program of study had been adopted but that cooperation from communities in supplying data and records had been disappointing; only 10 per cent responded to questionnaires. The committee is working jointly with the New England Water Works Association, and is seeking data on the change of flow coefficients in water pipe lines.

Maintenance work on earth fill drains of the Los Angeles water system was described by J. E. Phillips, engineer of the department of water power. The principal matters calling for attention, said Mr. Phillips, were the prevention of erosion on downstream faces by means of shrub planting, facing of upstream faces with concrete slabs or rubble work to minimize wave action, and grouting the interior wherever leakage takes place.

The summary of the papers on purification and water quality and those on management and accounting will be published in next week's issue.

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Big Hydro Project In Manchukuo

A PROGRAM of hydro-electric development which will ultimately provide 1,600,000 kw. has been put under way on the Yalu River, which flows between Manchukuo and Korea. Work was started in December on a dam at Fuihodo which will ultimately generate 640,000 kw. The work is being carried out by the Yalu River Hydro-Electric Co., a quasi-public corporation established by the government of Manchukuo and Korea.

The plant will start generating about 300,000 kw. of power by the end of 1941, it is planned, and will generate 640,000 kw. at the end of the following year.

Outstanding feature of the Fuihodo plant will be seven generators larger than those at Boulder Dam. They will have a capacity of 92,000 kw. each as compared with 82,500 for the Boulder generators.

The Fuihodo dam, 298 ft. high and 2,730 ft. long, will contain 3,530,000 cu.yd. It will have a storage capacity of 5,920,000 acre-ft.

THE WEEK'S EVENTS

(Continued from page 671)

Bids Asked on Section Of Contra Costa Canal

Bids on construction of an additional eight miles of the Contra Costa Canal will be opened May 20 by the Bureau of Reclamation. The contract for excavation of the initial section, a 4-mile earth ditch, is 60 per cent completed.

The Contra Costa Canal, a part of the Central Valley project in California, will supply fresh water for industrial and agricultural use to plants along the south shore of Suison Bay, and for domestic use in several municipalities in Contra Costa County. It would have a maximum capacity at its upper end of 350 sec.-ft., diminishing along its 46-mile course as water is taken out at various delivery points.

The contract now being advertised is for a concrete-lined section extending from Oakley to a point near Antioch. It will involve excavation of more than 500.000 cu.yd. of earth and rock, construction of a 1,360-ft. tunnel and of seven reinforced concrete siphons and five highway bridges.

This section of the canal will be about 25 ft. wide at the water surface, 7 ft. wide at the bottom, and will carry water about 7-1/3 ft. deep. The tunnel portion will have a 9-ft. horseshoe section with a 5-in. concrete lining.

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A.S.T.M. Will Discuss Impact Testing

A symposium on impact testing will be the outstanding feature of the annual meeting of the American Society for Testing Materials to be held in Atlantic City June 27-July 1. Arranged in cooperation with the American Welding Society, the symposium will present papers covering basic theories, factors affecting impact, and the practical application of impact tests to various substances.

On the question of factors affecting impact, papers will consider shape or notch effects, velocity effects, and temperature effects. These will be considered in relation to both homogeneous and welded materials.

Other subjects of interest to civil engineers on the agenda include a series of papers on water for industrial use; the fatigue of metals; and several studies of brick masonry and reinforced concrete.

Telephone Research Chief Gets Washington Award

The Washington Award Commission of the Western Society of Engineers will present the award on May 5 to Frank B. Jewett, president of the Bell Telephone Laboratories and vice-president of the American Telephone & Telegraph Co. The award is presented to Dr. Jewett "for inspiring and directing scientific research leading to improvements in the art of communication."

The Washington award was established in 1916 by John W. Alvord, Chicago sanitary engineer. It is administered by the Western Society of Engineers in cooperation with four other national engineering societies.

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Gate Contracts Are Let For Coulee and Seminoe

Contracts for supplying eight 102-in. ring-seal gates for use in the outlet channels at Grand Coulee Dam and for three similar gates for use at Seminoe Dam have been awarded by the Secretary of the Interior. The Consolidated Steel Corporation, Ltd., of Los Angeles will furnish 43 of the gates at a bid price of $1.090.000, and 40 will be furnished by the Joshua Henty Iron Works of San Francisco for $854.000. Awards were made to the lowest qualified bidders from sixteen proposals received March 31.

The gates for Grand Coulee will control the middle and upper tier of outlet channels. The outlet works at Grand Coulee consist of 102-in. pipes arranged in three tiers of 20 each. Each pipe will have a control gate at the upper and the lower end.

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Big Order Is Placed For Fabricated Houses

An order for 436 prefabricated houses, costing about $500.000, has been placed with the Harnischfeger Corp. of Milwaukee. The houses are to be two-story brick veneer structures built wall to wall, Philadelphia row style. They will be built in Upper Darby, Pa., by John H. McClatchy, Philadelphia real estate operator. The first lot of 113 units will be shipped in about two weeks and the remainder will begin going out in June.

California Road Tunnel To Be Made a Cut

Newhall Tunnel, which now creates a serious bottleneck on highway No. 7 north from Los Angeles, will be eliminated by the new Mint Canyon Cutoff, on the first section of which bids were opened by the California Division of Highways April 28. The Griffith Co. of Los Angeles submitted the low bid of $348.000 for the 3.73-mile section.

The tunnel, now only 16 ft. wide, will be daylighted to provide a 64-ft. open cut roadway in the same location. Maximum depth of excavation for this operation will be 180 ft., and the cut will involve excavation of nearly 300,000 cu.yd.

The cutoff runs from Tunnel Station on the Southern Pacific to Solamint. When completed, it will save 5.5 miles between Los Angeles and Mojave and provide a 64-ft. roadway the entire distance.

Completion of the first section is expected in about a year, and it is planned to complete the entire project by Jan. 1, 1940.

OBITUARY

James C. Twohy, 49, Spokane contractor, died April 25 at Portland, Ore. He had been associated for many years with the contracting firm of Twohy Bros. which was founded by his father. During the war he served overseas with the 18th Engineers.

James M. Lynch, superintendent of the water department of New Britain, Conn., for the past eight years, died April 28 at the age of 52. Lynch had been connected with the water department about 35 years.

Frederick W. Ullius, special assistant city engineer in Milwaukee for the past ten years and in the city service since 1923, died April 28 in Milwaukee at the age of 50. Ullius graduated from Wisconsin University in 1911 and two years later became city engineer of the Village of Shorewood, a position he held until he went to work for the city. In the Milwaukee engineering department, he served as supervisor on special projects, notably state flood control work on the Milwaukee River. He was secretary of the Milwaukee chapter of the Am.Soc.C.E.

John J. Dietz, former commissioner of water supply, gas and electricity of New York City and long active in Manhattan politics, died May 4 in White Plains, N. Y., at the age of 65.

PERSONAL

William R. Martin, project engineer for the Department of Agriculture stationed at Marianna, Ark., has been transferred to the position of regional engineer in the northern Great Plains region for the Bureau of Agricultural Economics. Martin is now stationed at Denver.

Charles D. Clark has resigned his position as subdivision engineer of the Los Angeles County Regional Planning Commission to take a position with the Federal Housing Commission.

J. E. Dunn has been appointed district engineer for the Portland Cement Association at its Richmond, Va., office. Dunn succeeds H. D. Humphries, resigned. He has been with the association since 1925 when he was made field engineer in Tennessee. He was district engineer at Nashville from 1929 to 1931 and since that time has continued as field representative for the association in Tennessee. Prior to his connection with the association, Dunn served as junior engineer for the Kentucky department of state roads and highways and as plans engineer for the Tennessee department of highways and public works. He is a graduate in electrical engineering of Purdue University, 1920, and in civil engineering of Vanderbilt University, 1923.

Irving V. A. Huie, who has been deputy commissioner of the New York City Department of Public Works, has been given additional duties by his appointment to the combined position of chief engineer and acting deputy commissioner of the department. Huie, who served in the First U. S. Engineers of the 71st Division during the war, was formerly deputy of the New York State Highway Commission and lately has been deputy director of the works division of the Emergency Relief Bureau and head of the works division of the WPA.

Joseph Hewitt has resigned as assistant city engineer of Zanesville, Ohio, to take a post with the WPA.

Finley B. Shappelear has been appointed assistant city engineer of Zanesville, Ohio, to succeed Joseph Hewitt.

James H. Mooney, engineer inspector for PWA at Boston, has been appointed building commissioner of Boston. Mooney, a graduate of Wentworth Institute, was for some years associated with Ralph H. Doane as a structural engineer and was later chief engineer for the Boston Park Department on PWA projects.

Edward W. Roemer, for eight years building commissioner of Boston and for fourteen years deputy commissioner, has resigned to become New England manager of the contracting firm of James Stewart & Co. Roemer entered the construction field in 1900 in the employ of the Woodbury & Leighton Co. of Boston. After association with a number of other contractors, he entered the city service in 1910 as an inspector. Roemer has been active in the formulation of building codes. He was chairman of the committee which drew up the Boston code and for 8 years he has been chairman of the building code committee of the New England Building Officials Conference; he is also chairman of the sponsors of the sectional committee on the administration of the building code correlating committee of the American Standards Association. He is a past president of the New England Building Officials Conference and the Building Officials Conference of America.

Keyes C. Gaynor has been appointed city engineer of Sioux City. Gaynor held the same post previously from 1910 to 1912.

Charles E. Carey has been made principal construction engineer in charge of all engineering construction for the Bonneville administration under J. B. Ross, administrator. Carey, an electrical engineer, has been practicing as a consultant since 1934 and for ten years previously was engineering supervisor for the Northwest for Westinghouse.

Lieut. Howard F. Ransford of the navy civil engineer corps, who has been stationed at the naval air station at Penascola, Fla. has been assigned to duty as public works officer at the naval station in Guam.

Charles W. Britzius has taken over the practice of the Quincy A. Hall Testing Laboratories under the name of Twin City Testing and Engineering Laboratories. Britzius graduated from the University of Minnesota in 1933 and for three years thereafter was employed by the Hall Laboratories. He taught at the university for a year as an assistant instructor, later worked for the Minnesota highway department as a soil engineer, and has just completed work for a master's degree in civil engineering.

Hugh B. Bradley has been appointed Southeastern district engineer of the South Carolina state highway department to succeed Howell C. Jones, resigned.

W. N. Spruill has been appointed division engineer for the fifth division of the North Carolina state highway public and works commission to succeed the late S. M. Gibbs. Spruill has been with the highway commission for the past 17 years.

John A. Trader has been appointed special bridge engineer for Jefferson county, Ala. He will inspect county bridges and recommend and supervise necessary repairs.

Winifred W. DeMay has been made division engineer in charge of surveying for the Hartford, Conn., engineering department, succeeding the late Herbert G. Clark. DeMay has been connected with the engineering department for 23 years.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

Associated General Contractors of America, spring board meeting, French Lick, Ind., May 16-18.

American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, June 27-July 1.

Society for the Promotion of Engineering Education, annual meeting, Texas A. & M. College, College Station, Texas, June 27-30.

American Institute of Electrical Engineers, summer convention, Washington, D. C., June 20-24.

REGIONAL AND LOCAL

Maryland-Delaware Water and Sewerage Association, annual conference, Emerson Hotel, Baltimore, May 19-20.

Section Meetings, American Water Works Association:
Pacific Northwest, Spokane, May 19-21.

New York State Society of Professional Engineers, annual meeting, Hotel Commodore, New York City, May 20-21.

Pennsylvania Sewage Works Association, annual conference, State College, Pa., June 8-10.

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License Examination

Louisiana, personal appearance of applicants for registration of civil engineers and surveyors May 18; written examinations May 19-20.